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Design, Development and Implementation of e-Managemnet System: A Case Study Of Ministry of Education, Science and Technology.

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ABSTRACT

Ekiti is one of the first areas to embrace modern Western Education, and today it is possible to find people whose great-grand- parents were well educated. It would be impossible to find a home where nobody is educated; rather, most homes can boast of at least a person with tertiary education. Every community has access to educational facilities of one sort or the other, raging from the pre-primary and primary, to secondary and tertiary levels. Since education is on the concurrent list, there are private as well as public institutions all around the towns and villages in Ekiti State. The State's Ministry of Education, Science and Technology leverage on the possibilities through information and communication technology to deploy her internal and external services using these tools rather than manual data processing.

The Ministry of Education (MOE), in collaboration with its parastatals, is charged mainly with the administration of Education in the State. The Ministry of Education has the responsibilities of

implementing all the Educational policies and ensures conducive learning environment. The Ministry manages all Public Schools in the State. It sets standard, maintains quality control and articulates Educational Programs.

With the help of web-based technologies, governments as well as citizens have efficient possibilities for providing and acquiring information. Especially the rapid evolution of the WWW and the available telecommunication infrastructure within the past decade has led to a massive increase of knowledge in the field of research of e-Government.

Keywords: Design, Development, Implementation, e-Management, e-Government, Education

1.0 INTRODUCTION

Governmental institutions are faced with the growing demand of restructuring their work to lower costs and to improve the quality of people oriented services. The support of information technology to satisfy these demands and improve the level of publicly offered information about governmental issues is increasing rapidly. Traditionally, governmental institutions benefited from information technology deployed for back office operations and front office functionalities covering at most basic contact functionalities of administrative agencies with citizens (Lenk and Wimmer, 2002).

The application of information and communication technologies for innovating and modernizing all levels of government - city, state, and country - is referred to by e-Government (Wimmer and Tambouris, 2002). Electronic Government (e-Government) is the application of concepts, techniques and tools of the "Information Age" to all activities related with the government, the Public Administration, and political decision making: execution of administrative procedures, tax payment, votings, public debates, public budget elaboration, law elaboration,

among others. e-Government operations cover the interconnection of front and back office functionalities, the composition of administrative processes and the integration of all participants and stakeholders of governmental operations regarding different views on these processes.

Ekiti State has no significant e-Government portal except the website containing sketchy information about the history of the state, culture and agriculture. There exist various social sites like Facebook, Twitter, etc about the state which of course cannot be compared to the endless possibilities and advantages of a well-structured educative, innovative, high-value and informative that e-Government portal provides. This opportunity exists to put the State Ministry of Education, Science and Technology on the global stage of digitalizing the State Secondary Educational Services accessible 24/7 through a developed well secured e-Management System.

This research work is divided into different sections. Section one discusses the background to the study-introduction into the research work, Research objectives, Motivation, and Methodology. Section two in its context explains the Literature Review, while Section three dealt with the systems Design, development and implementation of e-Management educational resourceful portal. Finally, Section five discusses the summary, conclusion and recommendation.

1.1 STATE MINISTRY OF EDUCATION, SCIENCE AND TECHNOLOGY

The Ministry of Education, Science and Technology has the responsibility of supervising all other educational agencies headed by Directors. There are seven departments:

a. Planning, Research and Statistics;

b. Inspectorate;

c. Schools' Department;

d. Tertiary Education;

e. Evaluation and Standard;

f. Science and Mathematics Technology;

g. Finance and Administration.

The Ministry similarly supervises all other parastatals, which are also eight in number:

i. Agencies for Adult and Non-Formal Education, which oversees matters relating to mass literacy and adult - education;

ii Teaching Service Commission (TESCOM), which oversees matters relating to employment and teachers' welfare in Secondary Schools;

iii. State Universal Basic Education Board (SUBEB), which is responsible for the employment, and welfare of teachers, as well as provision of infrastructural facilities at the Basic Education level.

iv Board for Technical and Vocational Education, which controls matters relating to Technical and Vocational Education;

v. Scholarship Board, which organizes and supervises issues relating to awards of scholarships to Ekiti State students;

vi. Library Board, which handles all matters relating to library activities;

vii. School Enterprises Board, which introduces students to entrepreneurial skills;

viii. Education Endowment Board (EEB).

The challenge for government is how to move on from focusing on service delivery to providing people - centered tools and applications (Kerby, 2005). This means placing a priority not just on how services are delivered to the citizens, but using e-government to enrich the lives of its citizens. e-Management should also be employed to improve the way public servants use public resources to support the society. Access to the services rendering by the above mentioned parastatals and agencies under the Ministry of Education, Science and Technology (MOEST) should be easily and

readily available to the people not minding the time and distance constraints by harnessing the potential of the modem technologies (ICT).

e-Management system for the Ministry of Education, Science and Technology, Ekiti State would make internal communication easier for government, parastatals, agencies and for the people to keep up with what is going on in the State's Education Sector and receive accurate information. Document can be approved and distributed electronically rather than printed and reviewed in paper. It will provide better customer services in a way that flow of information and services to the public are available even when government offices are closed on 24/7 basis from any where in the world through the internet self-service. Moreover, by doing this, time and energy of government staff are conserved to meet the needs of citizens who have to be attended to in person. However, the usage of this ICT driven educational portal system will drastically reduce the inefficiencies inherent in manual systems by automating functions and de-skilling routine processes. For example, the information for those willing to re-register for school Certificate exams (WAEC & NECO), JAMB preparatory classes and centers would be available on the e-Management portal among other services the Ministry of Education, Science and Technology through her parastatals can rendered for the people. Finally, Government can through this medium channel their commitments, showcase their achievements among others to the people.

Presently, at the Ministry of Education, Science and Technology across all the departments, parastatals and agencies, records and services are cumbered with data redundancy, poor storage and processing methods, misplacement and improper handling of records and delayed in processing of services are the order of the day.

1.2. RESEARCH MOTIVATION

Education is the bedrock of any development. But, response from the ministry of education,

science and technology staff to educational related matter from schools, public, government or individual takes time due to the manual based paper method used in processing information. However, the State has a website containing only the history, culture and geographical information about towns and villages in the state. This could be considered grossly inadequate to what e-Management is and can do with reference to the prevailing level of ICT in the world today. ICT plays a critical role in speeding up the flow of information and knowledge between government and citizens and transforming the way in which governments and citizens interact. According to the United Nations Development Programme (UNDP) the challenge for all countries is to create and develop a system of governance that promotes supports and sustains human development. Governments in many parts of the world have made huge ICT investments aimed at improving governance processes (UNDP, 2006). Moreover, there is no dedicated website developed to showcase the activities, programs and policies of education in Ekiti State where Education is the major industry.

Of the continents that have substantial rates of e-Government failures, Africa rates amongst the highest (Heeks, 2003). Surprisingly, none of the 10 leading global e-Government countries emerged from Africa, where many developing countries are located. The only African country to be listed among the first twenty countries of the world and to achieve a significant level of e-Government success is South Africa (Bates et al, 2007; Ifinedo, 2005). In terms of e-Government adoption, the gap between developed and developing countries is increasing (Bates et al, 2007). This means that such countries could be disadvantaged when competing with developed countries. Development of e-Management system for the State Ministry of Education, Science and Technology **(eMMOEST)** would provides many opportunities to improve the quality service to citizen, employees, non-governmental/non-profit bodies, business partners and associates to the ministry of education, science and technology and vise visa. The motivation nurtured and

fascinated the thought of developing a system that would manage an e- government models for improved quality educative and informative services delivery to the citizen of the Ekiti State through the Ministry of Education, Science and Technology.

Through this system, there would be constant information about the activities of government on education available on-line at anytime and accessible anywhere provided there is network. This will assist individuals (inside or outside the Ekiti State) to be informed about the educational development and progress of events. This therefore warranted the need to developing an integrated e-Management portal system to fill this vital vacuum. When this is achieved the following among others will be the benefits; transparency, accountability, better performance and interactions among parastatals, agencies to foster the making of quick decisions service processes, and values would be enhanced and lowered the costs.

1.3 RESEARCH METHODOLOGY

Analysis and assessment of the impact of e-Management were conducted through interview and records study techniques. Required data and information were obtained by interviewing some of the Ministry's personnel - Commissioner, Permanent Secretary, Executive Secretaries, Directors and Chairmen of Boards. Some data were extracted from the available/existing records by studying in details the organogram, staff and students enrollments and records of available facilities.

The result obtained from the assessment of the manual/traditional approach of processing data in the Ministry of Education, Science and Technology formed the basis for the design of an interactive, educative and resourceful management portal focusing on Government to Citizen (G2C), Government to Business (G2B) and Government to Employees (G2E) models for the information delivery. Access and modification to classified/confidential information were restricted to unauthorized people; so also the information system itself. An access control

measure was established based on the principle of Bell Lapudala model which restrict unauthorized access, modification of sensitive information and securing information on the database. This model was used to enforce access control in the applications whereby the subject (who is an active entity, in the form of a person, process, or device that allows information to flow among objects or changes the system state) supply his usemame and password before being granted access to the object and in determining the access level. The security of the model was guaranteed by the use of Rivest Shamar Algorithm (RSA) (a public key cryptographic techniques for encryption purposes) to scramble classified information.

The Subject, which may be Commissioner of Education, Science and Technology, Permanent Secretary, Director, Executive Secretary or Chairman of Board, will select from the list of options available on the menu based on the scheduled of operations after the authentication of the username and authorization of the password. Let SK, where k = 1,2,3,4 denote all the subject class defined as follows:

SI = {C}; C stands for Commissioner of Education, Science and Technology

S2= {PSAANFE, PSSB, PSTESCOM, PSSEB}; PS stands for Permanent Secretary in each Parastatal.

S3= {DAANFE, DSB, DTESCOM, DSEB}; D stands for Director in-charge of each Parastatal, while

S4= {HS}; HS stands for Head of Schools.

The different subject category can be grouped together to form a general class given as: Sk= {S1, S2 S3, S4}, and Sl> S2> S3> S4. S1 is the highest level of access into the system in the categorization.

The object is a passive entity that contains information (educational services) being protected. The Parastatals concerned are; Agencies for Adult & Non-Formal Education (AANFE), Scholarship

Board (SB), Teaching Service Commission (TESCOM), and School Enterprises Board (SEB). The educational services meant for the populace to subscribe for at the different parastatals are defined as follow;

Online filling of form to enroll for the Adult literacy class (RALC), Online filling of form for remedial JAMB,WASSCE,NECO and NABTEB coaching classes (RJWNNCC), Online filling of Scholarship form (SF), Online registration for the Library use (RFL), Online exchange of information from schools to the Ministry of Education, Science and Technology and vice versa (MIS), Online filling of Staff Bio-data (SB), Online filling of Transfer form (TF), Online filling of Employment Form (EF), Online application for Staff

Welfare Scheme (SWS), Online Advertisement of Products from School Enterprise

Projects (AP), Online Ordering for Products from School Enterprise Projects (OP), and Online Registration by the Cyber Cafe for Schools e-WASSCE/NECO registrations for certificate examinations (RB).

The e-Management System for the Ekiti State Ministry of Education, Science and Technology (eMMOEST) can be mathematically represented as follows:

eMMOEST = {OAANFE, OSB, OTESCOM, OSES} where the following defined the services offered by each of the parastatal to the stakeholders -

o_{AANFE}, = { o_{RALC}, $o_{RJWNNCC}$},

o_{SB} = {o_{SF} , o_{RFL}},

o_{TESCOM} = {o_{MIS}, $o_{SB,}$ o_{TF}, o_{EF}, O_{SWS} },

o_{SEB} = { o_{AP},o_{OP},o_{RB} }

The feed back may be in the form of approval to an obligation requested by the public, employees, etc.

The security classes are expressed in the form of S_CO_{AANFE}, and contain the following:

$S_CO = \{S_1O_{AANFE}, S_2O_{sB}, \mathbf{S}_3O_{TESCOM,} S_4O_{sEB}\}$

The Subject in a particular class is restricted to view objects meant for that class. In other words, for a subject to be able to view an object, the subject must belong to the class that has clearance for that object. The different services available for the different users at a time (t) are defined as Ox below:

Ox (x € {RALC, RJWNNCC, SF, RFL, MIS, SB, TF, EF, SWS, AP, OP, RB}) denotes all the object classes.

Supposing there is a direct mapping between the elements of k and x, this implies that every element of k takes a corresponding element of x.

S_k combines with Ox to give the following instances:

$S_k : Ox \longrightarrow S_1OAANFE$

$S_k : Ox \longrightarrow S_2OSB$

$S_k : Ox \longrightarrow S_3OTESCOM$

$S_k : Ox \longrightarrow S_4O\ SEB$

Therefore,

$$A = \begin{cases} 1 \text{ iff } S \in S_K O \in \{AANFE, SB, TESCOM, SEB\} \\ 0 \text{ iff } S \notin S_K O_X \end{cases}$$

Where A Stands for Access, S= Subject, S_k = Subject Class, O_x = Object Class. The system will be implemented using HTML and PHP for the frontend and MySQL for Database.

1.4 SYSTEM ARCHITECTURE AND CUSTOMIZATION.

Educational resourceful government portal for the information delivery model centering on Government to Citizen (G2C), Government to Business (G2B), Government to Non-government/Non Profit Organizations (G2NGO/NPO) and Government to Employees (G2E) among others is designed based on "open source" standard and can be deployed on Oracle, SQL, MySQL, Microsoft and other Enterprise Web Platforms including Java,Microsoft.Net among others.

2.0 RELATED WORKS

Haroon Shahzad Wagas Younas Sandhti(2007) through the E-Government services in Parkistan employed discussion and exploratory research methods to carry out the survey of certain people, their experiences and requirement about e-services, obtained the statistics of citizens who have basic IT knowledge and insight concerning research question. E-Government is one of the means through which services to the citizenry can be improved, get across to the people, and discover the services that will benefit the citizenry most rather than just feeling of what they need. Mere feelings without recourse to the interest of the citizenry do waste the limited resources. The Author was motivated to research into the services that would be of great benefit to the people. The Author was keenly interested in determining e-services required by the citizens and facilitates communication between the government of Parkistan and her Citizenry. The Author believed that the Citizens have to communicate with the government in their routines and activities in order to know their interest to be catered for that will be of benefit to them e.g. paying taxes, casting votes, registering child birth etc. The Author was able to establish the e-services that were of interest to the Citizens and enlisted areas of interest desiring improvement which include Education, Taxation, Utility Bills, Passports, Jobs, Health Care among others. Students and professionals were the participants considered as samples for

the study which is not adequate. Candidates of the entire populace like Artisans were left out which contribute the majority in a developing Nation like Parkistan.

Mahsa Fallahi (2007) in The Obstacles and Guidelines of Establishing E-government in Iran (Case Study of State Ministry of Commerce) used research questions as a search light to discover the obstacles and establish the guidelines. The sample questions are: What are the main obstacles of implanting e-government in the Iranian Ministry of Commerce? Which obstacles have the most effect on implementing e-government in the Iranian Ministry of Commerce? What solutions or guidelines could be offered for the Iranian Ministry of Commerce? From above the Author made used of sampling and data collection methods. Analyzed the data and therewith state the conclusions. The Author discovered the following obstacles as barrier to .the establishment and implementation of e-government in Iran a case study of the ministry of commerce; a) Lack of IT infrastructure among other obstacles is the most important barrier for implementation of e-government. b) Social and cultural obstacles, and c) lack of IT skills ,legal and security obstacles.

In the realm of government, ICT applications are promising to enhance the delivery of public goods and services to citizens apart from improving the process and management of government, but also redefining the traditional concepts of citizenship and democracy. The Author identified series of serious obstacles that could hinder the vision to be; citizen lack of awareness of electronic services and information, digital divide, and exodus of skilled workers. He asserted that these obstacles must be overcome in order to achieve the vision of e-government. The research work is limited in that the target populations for this study were managers and experts in Deputy of planning and Economic Affairs, Ministry of commerce.

2.1 e-MANAGEMENT

e-Management refers to electronic management. It was coined by Francis Ohanyido as part of the new evolving concepts around e-Governance. It is about the process of getting people together to accomplish desired goals. e-Management comprises planning, organizing, staffing, leading or

directing, and controlling an organization (a group of one or more people or entities) or effort for the purpose of accomplishing a goal through the deployment of ICT and manipulation of human resources, financial resources, and natural resources.

The term e-Government (e-Gov) emerged in the late 1990s, but the history of computing in government organizations can be traced back to the beginning of Computer history. E-government is defined as the use of information and communication technology to enhance access to, and delivery of government services for the benefit of all. It can be defined as the transformation of public sector internal and external relationships through internet - enabled operations, information technology and communications, to optimize government service delivery, constituency participation and governance. A literature on "IT in government", dated back to the 1970s (Kraemer, et al 1978). Gore (1993), stated that "The e-Gov was born out of the Internet boom. However, it is not limited to Internet use or publicly accessible system for direct use by customers or citizens." The prime objective of any technological revolution is to improve the quality of human life. This can be achieved by successfully assimilating these technological innovations into human society. Technological development in the information and communication technology has found its way into modern human societies through such concepts and practices as the e-govemment, e-govemance, etc.

E-government is the process whereby the use of information and communication technology and services is deployed and employed by the government in the delivery of services to members of the public and the use of same in the internal running and linkages among different government departments, commissions, parastatals, and agencies. E-government is a subset of the concept of good governance and SMART government. It is the very specific task of using the tools offered by information technology in various aspects of the process of the Ministry of Education, Science and Technology, with the objective of achieving efficiency, transparency, accountability and user

friendliness in all the transactions that the citizens and business conduct with the government. That is, providing digital interface in the government to citizen (G2C), government to business (G2B), government to government (G2G), recently, government to Non-Governmental Organizations (G2NGO), and government to Non-Profit Organizations (G2NPO) interactions. Specifically, it means using the tools of IT for enhancing the productivity, efficiency, of government organizations and quality of the delivery of services, covering diverse areas (World Bank, 2011).

e-Government offers the following benefits among others:

1. enable people will be better informed because they can get up-to-date and comprehensive information about government laws, regulations, policies and services.
2. creating a better business environment
3. strengthening good governance and broadening public participation
4. improving the productivity and efficiency of government agencies
5. improving the quality of life.

On this trend, Ekiti State Government is proposing to establish the Ministry of IT in which the e-Government Directorate would be created. Then, the State would have e-Ekiti. Ekiti State is a State in Southwest Nigeria, created on October 1st, 1996 by the military, General Sanni Abacha. There are Sixteen Local Government Areas. Ekiti State is one of the thirty-six States that constitute the Nigeria.

The State has eight (8) different Ministries. These are; Ministry of Health, Ministry of Lands, Housing & Environment, Ministry of Finance & Economic Development, Ministry of Youths & Sports Development, Ministry of Women Affairs & Social Welfare, Ministry of Local Government & Culture, Ministry of Works & Infrastructure and Ministry of Education, Science and Technology.

Table 2.1 shows the numbers of institutions in the State.

S/N	TYPE	NUMBER
1	Primary Schools	795
2	Private Nursery/Primary School	383
3	Secondary Schools	179
4	Private Junior Secondary Schools	134
5	Private Senior Secondary Schools	111
6	Technical Colleges	6
7	State College of Education	1
8	Federal Polytechnics	1
9	Private Polytechnics	1
10	State University	1
11	Private University	1
12	Federal University	1
13	Federal School of Nursing	1
14	State School of Nursing	1
15	School of Health Technology	1

2012 school census paper from Ekiti State Ministry of Education, Science and Technology.

The central theme of this study is focused on the activities of government on education available on-line and the development of an integrated e-Government portal that will improve the quality service delivery to the Citizen on education. Also, it is to showcase the educational services by the State Ministry of Education, Science and Technology to the people. This would be implemented with relevance to the following parastatals: Agencies for Adult and Non-Formal Education, Teaching Service Commission, Board for Technical & Vocational Education, Scholarship Board, Library Board, School Enterprises Board and Education Endowment Board (EEB).

Therefore, records identified for automation are; Information about Staff at the Ministry of

Education, Science and Technology, Ekiti State. Information about the services (as affected the different levels - citizens, government) rendering to the people and government of Ekiti State.

This can further be narrowed down to two major divisions, viz-a-viz;

1. Staff and Administration.

2. Services to the citizens and Activities within the Offices. However, this research work will be strictly restricted to the services to the citizens and activities within the aforementioned Parastatals in the Ministry of Education, Science and Technology. Consequently, in line with the objectives of this research works, the services to the citizens and the various activities on going in the parastatals would be treated and categorized under the following sub-heading:

e-Management of Government to Citizen (G2C): This is the online non-commercial communication between the people and the central government through the ministry of education, Science and Technology. In this model, government sectors or agencies services are actively and visibly available to citizens. The model makes it easy for citizens to find and use the high quality services they are appearing to benefit from the government. In the case of the Ekiti State Ministry of Education, Science and Technology, these services include among others the following:

a) Online filling of form to enroll for the Adult literacy class,

b) Online filling of form for remedial JAMB coaching classes,

c) Online filling of form for remedial coaching for WASSCE,NECO and NABTEB coaching classes,

d) Online filling of Scholarship form,

e) Online registration for the Library use and borrowing of Library materials.

f) Online sending of information from schools to the ministry of education, Science and Technology.

e-Management of Government to Employees (G2E) :This is the long term organizational effectiveness that would require efficient internal operations without sacrificing the quality of the services delivered to its customers. This should be continuously improved so that it will

improve the internal processes and service quality while driving down internal costs. Therefore, G2E offer the better use of technologies to government agency administration in order to reduce administrative and other costs while improving the quality of services by using the best fitted IT and industry practices in any areas such as financial management, knowledge management, and supply chain management. Hence, agencies are able to develop and improve the effectiveness and efficiency, reducing delay in providing the appropriate and accurate processes and services to the government employees and improving their satisfaction in order to make the better citizen services. These services include among others the following:

a) Online filling of Staff Bio-data,
b) Online filling of Transfer form within the State Ministry of Education, Science and Technology.
c) Online filling of employment/recruitment form
d) Online filling of Car/Housing Loan - Staff Welfare Scheme.

e-Management of Government to Business (G2B) : This is the online non- commercial model that makes the communication between the people and central government and the commercial business sectors (production and services) available rather than the private individual. In this model, better communication possibilities occur and therefore, reduce the government's problems on doing businesses by eliminating the collection of the redundant businesses data and information. These services include among others the following:

a) Online Advertisement of products (School Enterprise Projects),
b) Online ordering for products.
c) Online registration by the Cyber Cafe for e-WASSCE/NECO registrations of students for examinations.

It is pertinent to note that though the State Ministry of Education, Science and Technology is sub-divided into departments (educational agencies) and parastatals. This research work is majorly on

the parastatals. The departments (educational agencies) are listed below:

a) Planning Research and Statistics;

b) Inspectorate;

c) Schools' Department;

d) Tertiary Education;

e) Evaluation and Standard;

f) Mathematics, Science and Technology;

g) Finance and Administration.

The parastatals are supervised by the Executives Secretaries. These are listed below:

a) Agencies for Adult and Non-Formal Education

b) Teaching Service Commission, Board for Technical & Vocational Education

c) Scholarship Board

d) Library Board

e) School Enterprises Board and

f) Education Endowment Board (EEB).

At each of these offices, a Desk officer is designated to access the information and reply when necessary after due consultation with the superior officers for immediate response.

2.2 RESPONSIBILITIES OF THE DEPARTMENT/AGENCY/PARASTATALS TO THE CITIZENS

The functions performed by the different departments/agencies/parastatals under the State Ministry of Education, Science and Technology are stated below;

Ministry of Education

a) Monitor the delivery of educational services to ensure compliance with National Policy on Education

b) Sees to the establishment of new schools both Private and Public

c) Provides infrastructural facilities in schools

d) Provides running grants to Junior Secondary Schools in the State

e) Organizes various educational competitions among Secondary Schools like Science Olympiad,

Cowbell Mathematics, STAN Quiz Competition, etc

f) Maintenance and rehabilitation of dilapidated classrooms and schools

g) Supervises the activities of the Teaching Service Commission (TESCOM) and SUBEB

h) Coordinate the assistance of donor agencies like ETF,UNICEF, World Bank etc

SUBEB

a) Management of Primary Schools and nomadic education in the State.

b) Recruitment, appointment, promotion and discipline of teaching and non-teaching staff in Primary Schools

c) Purchase and distribution of instructional materials to schools

d) Posting and deployment of staff including inter-state transfer of primary school teachers

TESCOM

a) Ensure that minimum standard of Public Secondary Schools as may be prescribed from time to time by the appropriate authority are complied with

b) Organizes regular induction courses, seminars and workshops for its teaching and non-teaching staff

c) Compiles and maintain service records of the employees of the Commission

d) Registers teachers in Public Secondary Schools

e) Publishes from time to time the comprehensive list of teachers in Public Secondary Schools and ensure a regular personnel audit

f) Appoints, post, transfer and promote both teaching and non-teaching staff in Public Secondary Schools

g) Disciplines and exercises disciplinary control over its teaching and. non-teaching staff in accordance with existing regulations

Board for Technical And Vocational Education

a) To manage the affairs of Technical Colleges and Vocational Education centres in the State
b) To ensure that all Policies on Technical and Vocational Education given by the Federal and State Governments are fully implemented
c) To prepare salaries and allowances of the staff of the board and ensure payment
d) To carry out all such activities and such things as are necessary for the good governance, control and Administration of the Board and the Management of the Assets of the Board to perform such other functions as may be assigned to the Board by the Commissioner for Education and Executive Governor

Agency for Adult And Non-Formal Education

a) Organising and carry out literacy programmes, which shall include reading, writing, and numeracy, moral and civic education for adults in the State
b) Organising and carrying out rural continuing education programmes which may lead to acquisition of skills and certificates
c) Developing in adults, attitudes and commitments towards active participation in social and political life of their immediate locality and the nation at large
d) Regulating and supervising Adult and Non-Formal Education Programmes provided by other bodies besides the Agency
e) Developing in Adults, the ability to use skills acquired to enhance their knowledge and understanding of their social and physical environment in order to improve their makes of living

2.3 Database and Information System

The heart of any information system is a functional database. An information system is a collection of procedures, people, instructions and equipment to produce information in a useful form. Database and database systems have become an essential component of everyday life in modem society. In the course of a day, most people encounter several activities that involve

some interactions with a database. For example, making a hotel or online airline reservation, accessing a computerized library catalog to search for a bibliographic item, visiting the bank to deposit or withdraw funds, chances are that our activities will involve someone accessing a database. Database is defined as a file composed of records, each containing fields together with a set of operations for searching, sorting, recombining and other functions. It is an organized collection of related records about an entity.

A database must have two important features:

a. it must hold data as an integrated system of records

b. it contains self-describing information. The database must contain "meta-data" which is the description of the data in the database. This is referred to as schema.

2.3.1 Database Management System (DBMS)

A Database Management System is a set of programs whose function is to maintain a database result. It is a program that provides mechanism for storing and organizing data in manner that is consistent with database's format. It is a collection of logically related files. It receives a database requests, processes them, and returns the outcome information back to the requesting program. DBMS acts as an interface between the database and the user. It handles user requests for database actions and allows for control of security and data integrity requirements. The primary goal of DBMS is to provide a way to store and retrieve database information that is both convenient and efficient.This is illustrated using figure 2.1.

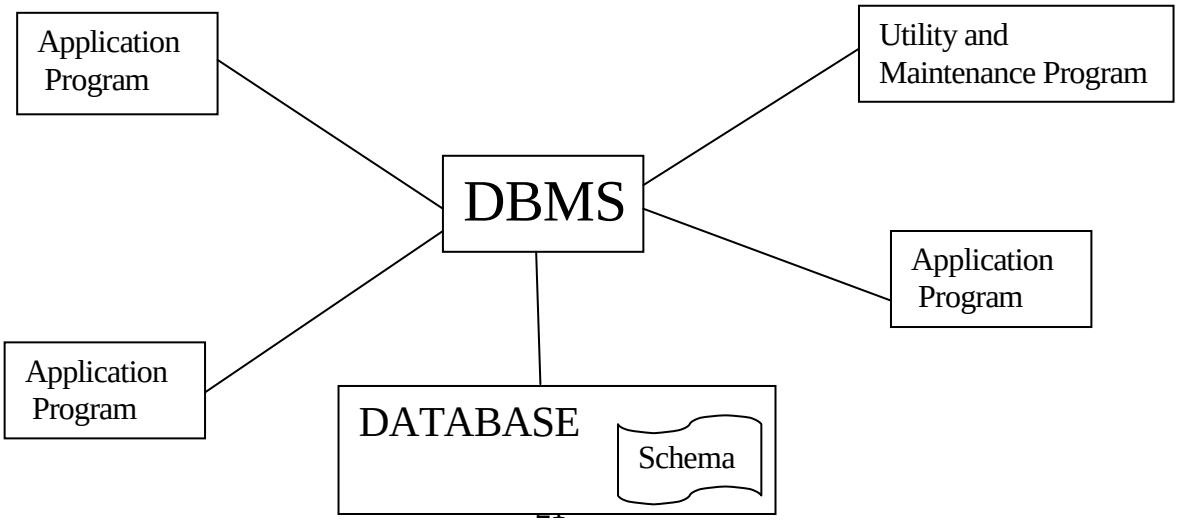


Figure 2.1: Conceptual view of a Database System

2.3.2 Database Modeling

A database model is defined as a container for storing data, and the process for storing and retrieving data from that container. A database model can be loosely used to describe an organized and ordered set of information stored on a computer. This ordered set of data is often structured using a data modeling solution in such a way as to make the retrieval of and changes to that data more efficient. The database designer uses database models as communications tools to facilitate the interaction among the designer, the applications programmer, and the end-user. If the database model is developed well and it is properly implemented, it can foster effective and efficient performance of the database. Good database design is the foundation for good application. The importance of database model cannot be overstated. Data constitute the most basic information units employed by a system. Applications are created to manage data and to help transform data into information.

The basic building blocks of database models are entities, attributes, and relationships. An entity is any distinguishable person, place, thing, or event, about which data are to be collected and stored. An attribute is a characteristic of an entity. For example, an entity USER would be described by attributes such as User Identification Number, Surname, Other names and Sex. Attributes are also called columns or fields.

A relationship describes an association among two or more entities. For example, there is a relationship between a user and the services government offered. Database models use three types of relationships: one -to-many, many-to-many, and one-to-one. Database designers usually use the shorthand notations 1 :M,M:N ,1:1 for them respectively. Although, the M:N notation is a standard label for many - to - many relationship, the label M:N may be used (Peter and Carol 2000).\

2.3.3 Types of Database Models

Atzeni, et al (1999) identified two major categories of database model: Logical model and Conceptual model.

Logical Model: This model describes the organization of data at a level that abstracts from physical structures. Examples include Hierarchical Model, Network Model, Relational Model, and Object Model.

i) Hierarchical Model

The hierarchical database model is an inverted tree-like structure. The tables of this model take on a child-parent relationship. Each *child table* has a single *parent table,* and each parent table can have multiple child tables. Child tables are completely dependent on parent tables; therefore, a child table can exist only if its parent table does. It follows that any entries in child tables can only exist where corresponding parent entries exist in parent tables. The result of this structure is that the hierarchical database model supports *one-to-many* relationships. This model suffers from redundancy problems and their structural inflexibility makes database modification difficult. See figures 2.2 and 2.3

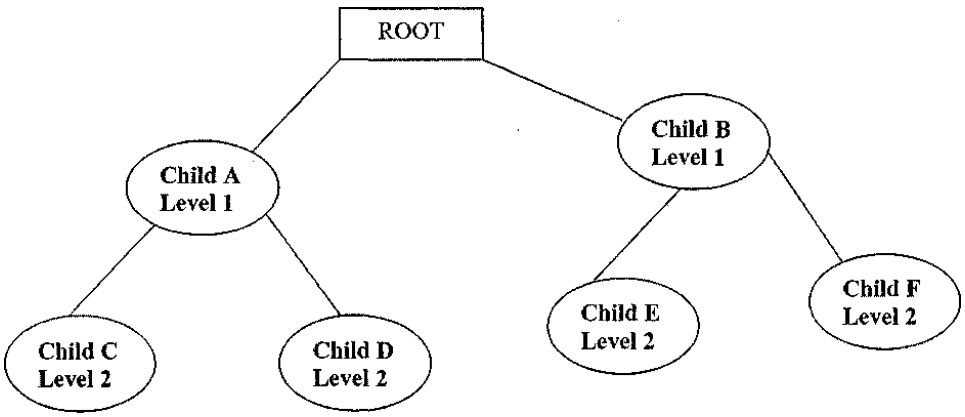


Fig. 2.2: Hierarchical Model

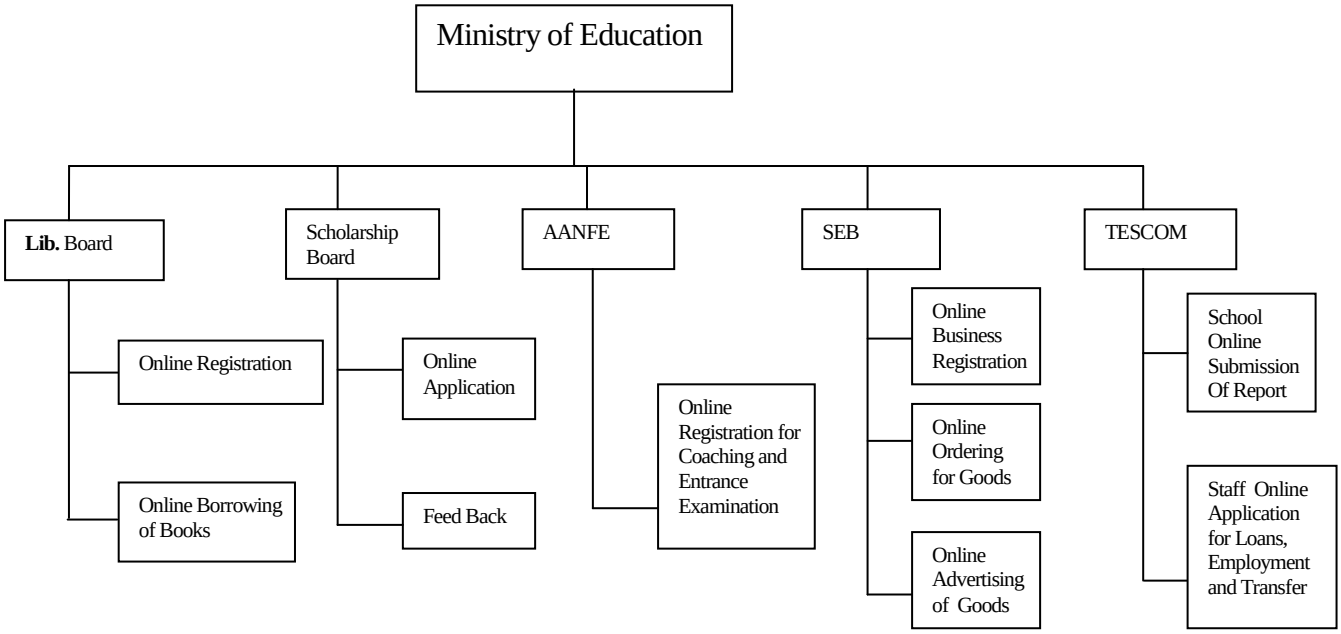


Fig.2.3: Hierarchical model showing relationship between Ministry (Government) and the Parastatals.

ii) Network Model

The network database model is essentially a refinement of the hierarchical database model. The network model allows child tables to have more than one parent, thus creating a networked-like table structure. Multiple parent tables for each child allows for *many-to-many* relationships, in addition to one-to-many relationships.

Network used in this context refers to certain data structure, not a data communications network like the Internet. In model network, data is stored in sets instead of the hierarchical tree format. This model has minimal redundancy but pay for that advantage with structural complexity. Thus, the model is difficult to implement and maintain. See figure 2.4

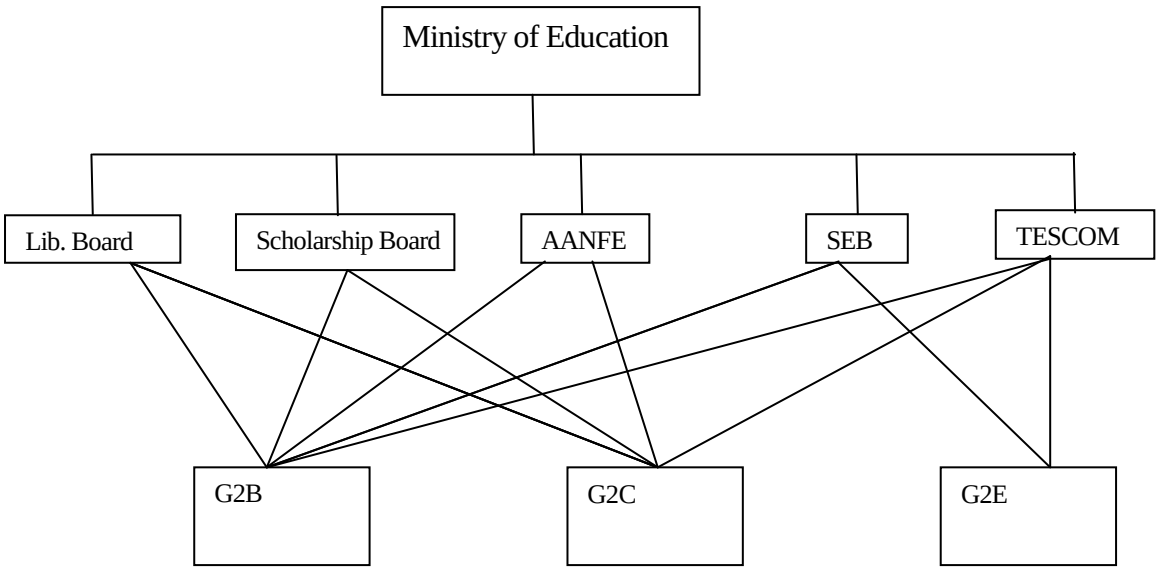


Fig. 2.4: Network model showing relationship between Government and the Parastatals.

A Mathematical Model For Fig 2.4

Lemma. Assuming that the middle units of the graph in Fig. 2.3 can be written as LB, SB, AA,

SEE, TES and those on the last level as G2B, G2C and G2E then are the degrees of the relation among these units and level can be evaluated.

1. The degree of the relation associated to Library Board is of the second order since the Library Board is linked to G2B and G2C.
2. The degree of the relation known to Scholarship Board is also of the second order since it is related to just G2B and G2C.

3 AANFE exhibits a second degree relation with G2B and G2C.

4 SEB also exhibits a second degree relation with G2B and G2E.

5 TESCOM shows a third degree relation with G2B and G2C and G2E

The relation that exists among G2B, G2C and G2E is a null graphical relation since there is no link among them.

To simplify the analysis of the fig. 2.4, we assume a vertex representation for the Ministry of Education is (eMMOEST) and for each Sub-Unit in the second and third levels so that Ministry of Education is labeled as vertex 1, Library Board as vertex 2 and so on and so forth.

Thus the adjacency matrix is given as:

	1	2	3	4	5	6	7	8	9
1	0	1	1	1	1	1	1	1	1
2	1	0	0	0	0	0	1	1	0
3	1	0	0	0	0	0	1	1	0
4	1	0	0	0	0	0	1	1	0
5	1	0	0	0	0	0	1	0	1
6	1	0	0	0	0	0	1	1	1
7	0	1	1	1	1	1	0	0	0
8	0	1	1	1	0	1	0	0	0
9	0	0	0	0	1	1	0	0	0

One good thing about this matrix is that it allows us to know if this system is an admissible, observable and controllable one.

If its inverse exists then, there will be a solution to the system.

By fig. 2.4, the Ministry of Education can be viewed as the integration of its sub -unit and each sub-unit can also be represented as of its mapping:

Ministry of Education (eMMOEST) = ∫[Lib. Board μ Scholarship Board μ AANFE μ SEB μ TESCOM] dt

→ Library Board = G2B ∩ G2C

Scholarship Board = G2B ∩ G2C

AANFE = G2B ∩ G2C

SEB = G2B ∩ G2E and

TESCOM = G2B ∩ G2C ∩G2E

Min. of Edu. = ∫[G2B ∩ G2C] dt μ ∫[G2B ∩ G2C] dt μ ∫[G2B ∩ G2C] dt μ ∫[G2B ∩ G2E] dt μ ∫[G2B ∩ G2C ∩ G2E] dt

Min. of Edu. =∫ $\bigcup_{i=1}^{3}$ [G2B ∩ G2C]i dt U ∫ G2B ∩ G2E] dt U ∫ G2B ∩ G2C ∩ G2E] dt

iii) Relational Model

The relational database model improves on the restriction of a hierarchical structure, not completely abandoning the hierarchy of data. Any table can be accessed directly without having to access all parent objects. The trick is to know what to look for — if you want to find the address of

a specific employee, you have to know which employee to look for, or you can simply examine all employees. You don't have to search the entire hierarchy, to find a single employee.

In relational model, data is stored in tables. Tables are called relations according to E.F. Codd. A table is perceived as a two-dimensional structure composed of rows and columns. In a relational model, you can choose which columns to retrieve from a table. By retrieving only the columns you need, you help to isolate your program from changes in the table. This means you can add and delete columns from a table as long as your program doesn't reference any of these columns, your program will continue to work without change. Columns are also known as fields or attributes. Records are called rows or turples.

Every table must have a column, or a combination of columns whose value uniquely identify each row. Such a column is called the primary key or candidate key. Primary key cannot contain a null value. No two values in the primary key column must be the same. A foreign key is a column, or a combination of columns, whose values match the primary key in another table. A foreign key links tables. Connecting two tables on a common field is referred to as "establishing relations".

Conceptual Model: Used to describe data in a way that is completely independent of any system, with the goal of representing the concepts of the real world. The most popular is the Entity - Relationship Model.

iv) Entity-Relational Model

The Entity-Relational (ER) model is a conceptual data model.lt is a high level description of data to be stored in the database, along with the constraints that are known to hold over this data. The entity-relationship (ER) model is based on a perception of a real world that consists of a collection of basic objects, called *entities*, and of relationships among these objects. In other words, E-R model allows us to describe the data in the real world in terms of object (entities) and their relationships. As earlier mentioned, an entity is a 'thing' or 'object' in the real world that is distinguishable from other objects. Entities have attributes and they have relationship. The set of all entities of the same type and the set of all relationships of the same type are termed an entity set and relationship set respectively.

The overall logical structure of a database can be expressed graphically by an E-R diagram, which is built from the following components, which are:

(i) rectangles, which represent entity set;

(ii) ellipses, which represent attributes; and

(iii) diamonds, which represent relationships among entity sets

Each component is labeled with the entity or relationship that it represents.

As an illustration, in Fig.2.5, the E-R diagram indicates that there are two entity sets, User and eMMOEST (Internet), with their respective attributes.

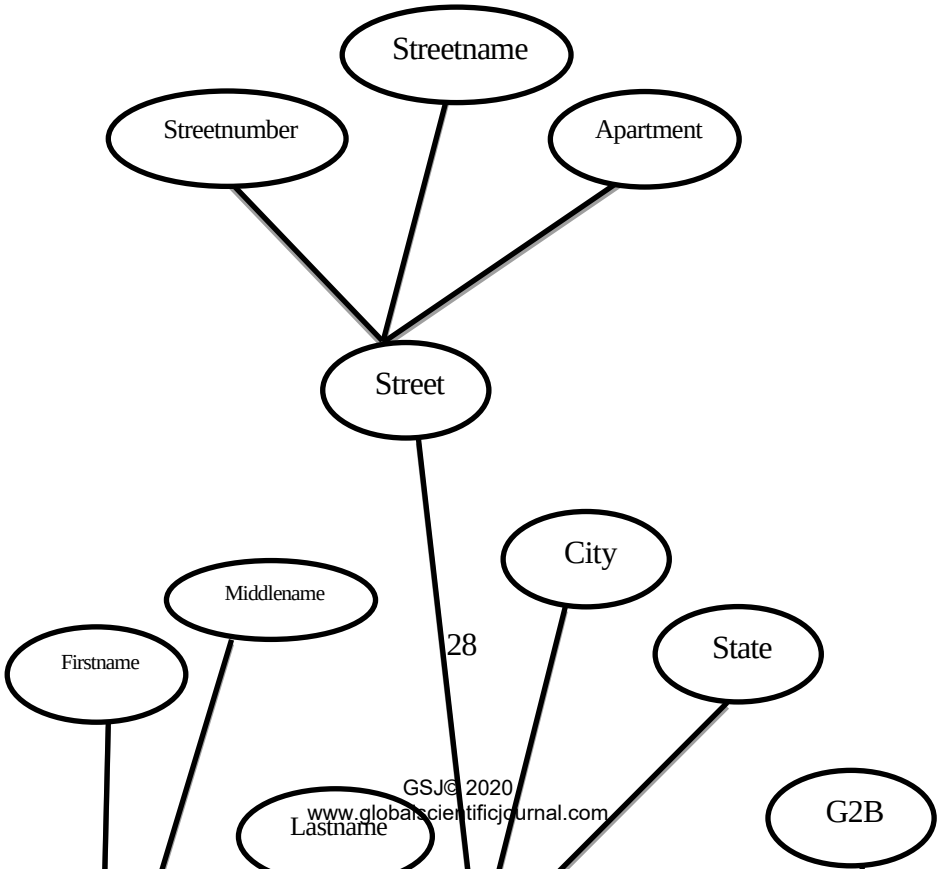
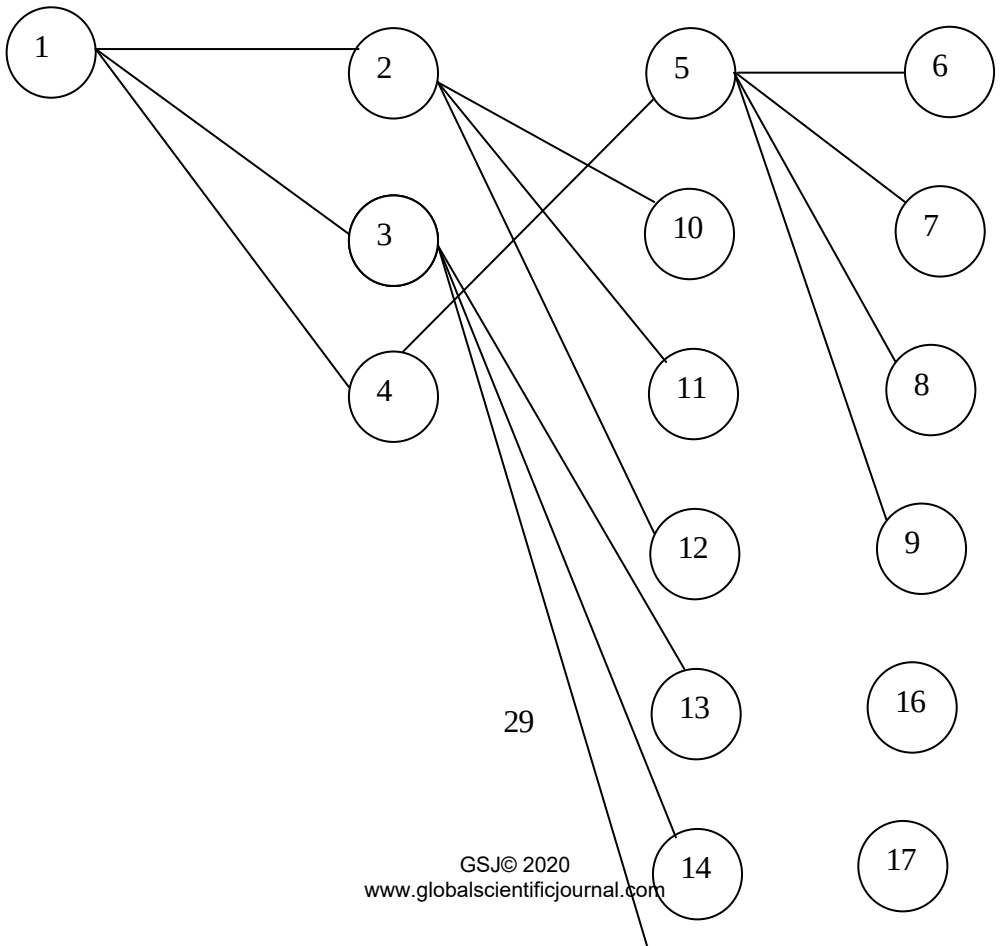


Fig.2.5: E-R Diagram Showing Relationship between Entity User and eMMOEST(Internet).

At a glance, Fig 2.5 appears like a ternary tree in figure 2.6, but not a full ternary three. Thus it is expedient to restrict it for a better evaluation as follows:



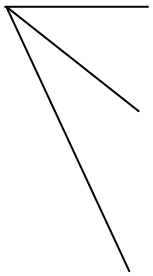


Figure 2.6: Tenary Tree

The associated Adjacency matrix is given as:

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	1	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0
3	1	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0
4	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	1	0	1	1	1	1	1	0	0	0	0	0	0	0	0
6	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0

10	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0

The understanding of this Adjacency matrix holds a lot of information. This enables us to see the degrees of the interactions that exist amongst the various units of the Ministry of Education, Science and Technology.

2.4 SECURITY

Security is a subjective feeling that is perceived differently by different people. What appear secure to one party may completely be insecure to another. It is necessary to know that one is protected as far as no attack has been suffered. For a system to be classified as secure, the systems should be able to prevent or detect unauthorized modification and use.

Security does not necessarily mean the absence of threats, risks or attacks rather; it involves putting in place appropriate measures to counter any threat issued. In other words, security is guiding against threats, risks or attacks by using the necessary machineries. Security as an integral part of information system design connotes the protection of information system against malicious attacks. Proper security of information and information systems helps protect electronic system sites, digital process controls, and telecommunications. Information security also helps deprive adversaries' information that might facilitate their actions against the company.

2.4.1 Bell-La Padula model

The Bell-La Padula Model (BLP) is defined as a state machine model used for enforcing access control in government and military applications. It was developed by David Elliott Bell and Leonard J. La Padula, subsequent to strong guidance from Roger R. Schell to formalize the U.S. Department of Defense (DoD) multilevel security (MLS) policy. The model is a formal state transition model of computer security policy (a description of security requirement for a system) that describes a set of access control rules which uses security labels on objects (A passive entity that contains or receives information. Note that access to an object potentially implies access to the information it contains) and clearances for subjects (An active entity, generally in the form of a person, process, or device that causes information to flow among objects or changes the system state (Gary et al, 2001)).

The Bell-La Padula model focuses on data confidentiality and access to classified information. Data confidentiality is the security goal that generates the requirement for protection from intentional or accidental attempts to perform unauthorized data read. Confidentiality covers data in storage, during processing, and while in transit. In this formal model, the entities in an information system are divided into subjects and objects. A system is said to be secured if the objects are viewed only by the permitted subjects, otherwise it is not secure. For a specific access mode to be allowed, the clearance of a subject is compared to the classification of the object (more precisely, to the combination of classification and set of compartments, making up the security level) to determine if the subject is authorized for the specific access mode. With Bell-La Padula, users can create content only at or above their own security level (i.e. secret researchers can create secret or top-secret files but may not create public files; no write-down). Conversely, users can view content only at or below their own security level (i.e. secret researchers can view public or secret files, but may not view top-secret files; no read-up).

3.0 SYSTEM DESIGN

In this section, the total set of functional and non-functional requirements are defined. The issues of why the system is needed, what the system will do, how the system will be accepted and

how the process is exactly carried out are clearly separated. The software piece that meet the requirements and the framework into which this piece fix to act as working whole are clearly defined. The products of design describe such things as software modules, data passed and shared among modules, and database organization.

3.1 PARTICIPANTS IN e-GOVERNMENT

A division in an external and an internal view on e-Government allows a basic differentiation. Citizens, employees, companies, and non-profit-organizations are participants on the external side, whereas public private partnerships and public authorities are considered internal participants (Wimmer and Tambouris 2002). Based on this clustering, the various parastatals existing in the Ekiti State Ministry of Education, Science and Technology can be grouped into these e-government models: Ministry of Education -to- Central Government (MOEST2G), Ministry of Education -to-Citizen (MOEST2C), Ministry of Education -to-Non-Governmental/Non-Profit Organization (MOEST2NGO/NPO), Ministry of Education - to - Employees (MOEST2E) and Ministry of Education -to-Business (MOEST2B) among others. These likewise, can be identified as types of communication which are part of governmental processes. See figure 3.1.

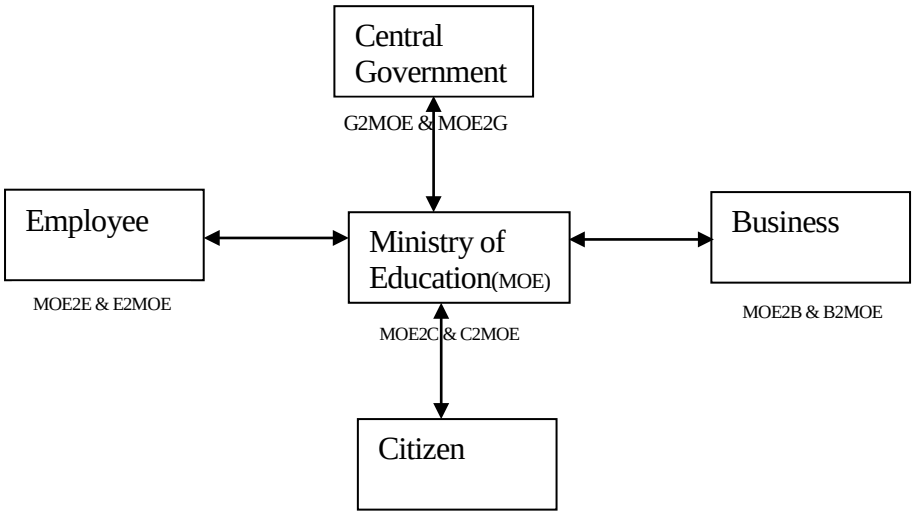


Figure 3.1 :Participants in e-Government

The mathematical model that reflects the divisions into an internal view on e-Government, which allows a basic differentiation of the form, is represented below:

Let eG be the e-Government system;

Let ev and iv be the external and internal views on eGovernment system then,

eGαev (iv) (1)

Since a divisional relation is exhibited.

That is, if; m = ev and k = iv, then

We obtain, eG = rmk (2)

Where, r is proportionality constant.

eG is a function of m and k which they themselves are function of other variables.

Assuming that m and k depend on time (t), then a differential relation is given as:

$$\frac{d[eG]}{dt} = \frac{d[rmk]}{dt} = r[\frac{dmk}{dt} + \frac{mdk]}{dt}$$

$$= r\frac{kdm]}{dt} + r\frac{mdk}{dt} \quad (3)$$

We process to model the various parastaltals existing in the state Ministry of Education,Science and Technology since it is an external participant in e-Governance:

Min. of Education [MOEST] $\alpha \sum_{i=0}^{n}(\mathrm{CGUNGOUBusinessUCitizen})i$

$\Longrightarrow$ MOEST is directly proportional to the sum of all contributions of CG,NGO, Business and Citizen. Thus, by introducing the proportionality constant, we obtain:

MOEST = $\alpha \sum_{i=0}^{n}(\mathrm{CGUNGOUBusinessUCitizen})i$

3.2 DESIGN OF e-MMOEST SYSTEM

e-MMOEST system is a collection of electronic files otherwise known as database. It can be accessed through terminals linked to the central server and designed to display information about the government to citizen, business, and employees among others. In other words, it is

designed as a multi-tier system consisting of three major subsystems as depicted in figure 3.1. and explained its components below:

a. the database system which houses the state ministry of education, science and technology' records from the related parastatals.

b. the interactive, informative and educative software package which among other things provides enabling environment for:

1. Capturing necessary inputs to the system.
2. Processing captured records to produce desired and appropriate reports.
3. Offering simple and effective user-interface for database query and retrieval of desired records.
4. Providing database backup
5. Specification of access level for ensuring confidentiality, integrity and authentication.
6. Users pre-registration before access to the online facilities such as filling of form to enroll for the adult literacy, remedial UTME coaching and WAEC/NECO preparatory classes, filling of the State Scholarship form and State Library user's form.
7 The Head of schools to register before access is given to submit report or any correspondence to the ministry of education, Science and Technology.
8. The Citizen seeking for employment with the Ministry of Education, Science and

Technology to register online, fill and submit the employment form.

9. The Ministry of Education, Science and Technology Staff seeking for transfer must register to fill the form and submit online.
10. The Ministry of Education Staff seeking for car/housing loan to register so as to be given access to the form to fill and submit online.
11. The Citizen willing to transact business with the State Ministry of Education, Science and Technology to register his business by filling the form and submit online.

12. The School willing to advertise their products or showcase the various educational or co-curricular activities going on in their schools to register online before allowed to doing so.
13. The Cyber cafe willing to participate in the online registration of school external exams (WASSCE, NECO) to register online before given access.

(c) A web-based system providing users feed back via the internet.

3.2.1 e-MMOEST DESIGN MODEL

eMMOEST Design phase is sub-divided into several phases. These phases consist of G2C, G2B ,G2E, Database Backup, Report Generation and Processing. The inputs to the model are the online services requested by the users and the feed back given as reply (report generation level) to by the appropriate parastatals or agencies concerned. Each of the phases is explained below and the Designed Model is depicted by figure 3.1.

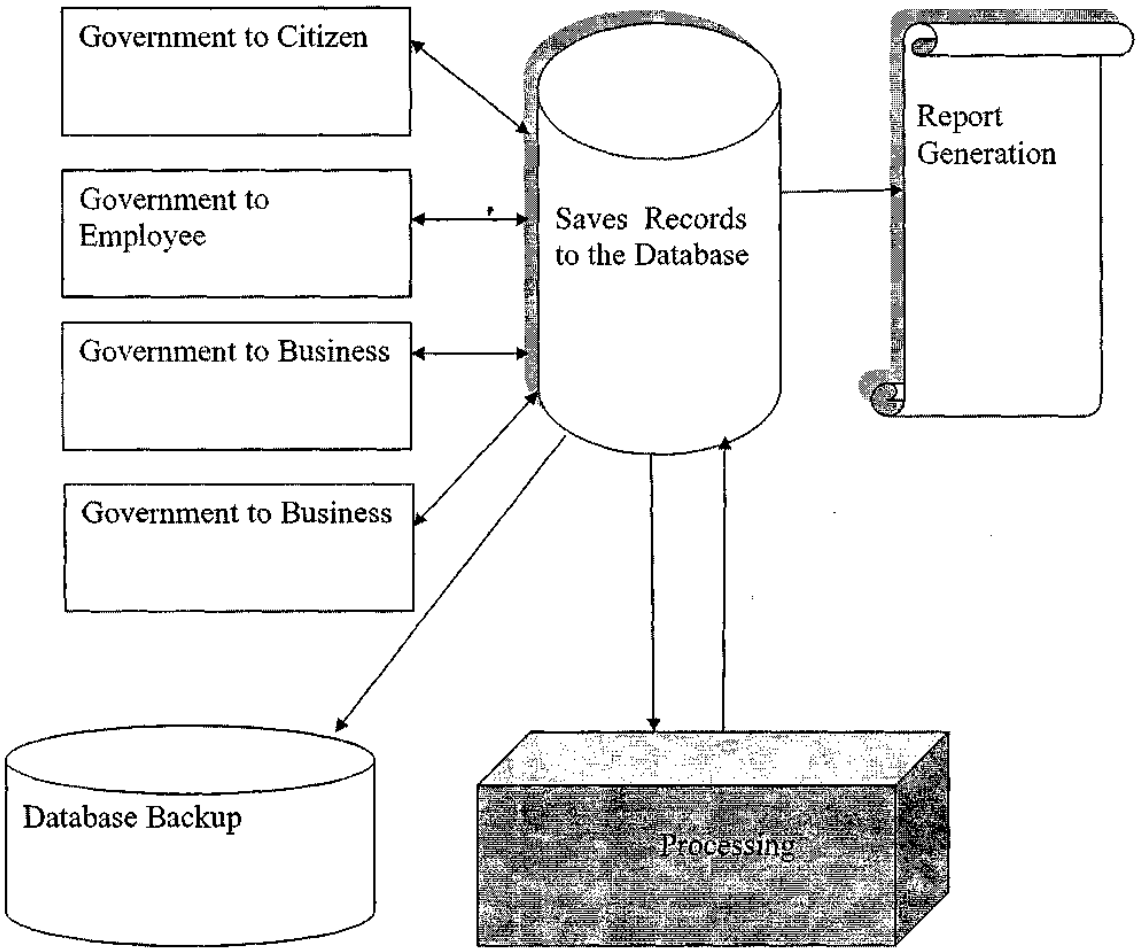


Fig.3.2: eMMOEST Multi-Tier System

i) Design of G2C

Immediately, the user login into the system and click to access the Government to Citizen Portal the user is presented with three menus as depicted in the figure 3.2. The information about the Scholarship opportunity in the State with the form for the prospective candidates to fill and Submit online for processing, registration for the continuous education program for the external candidates willing to enroll for either Coaching classes or Examination with WASSCE, NECO or JAMB, The portal will also allow different Cafe centers to register so as to enable them to partake in the online registration exercises for both the internal and external candidates. Through this portal, citizens concern can also register for the use of reading materials available at the Ekiti State Library. This information is shown in the figure 3.2.

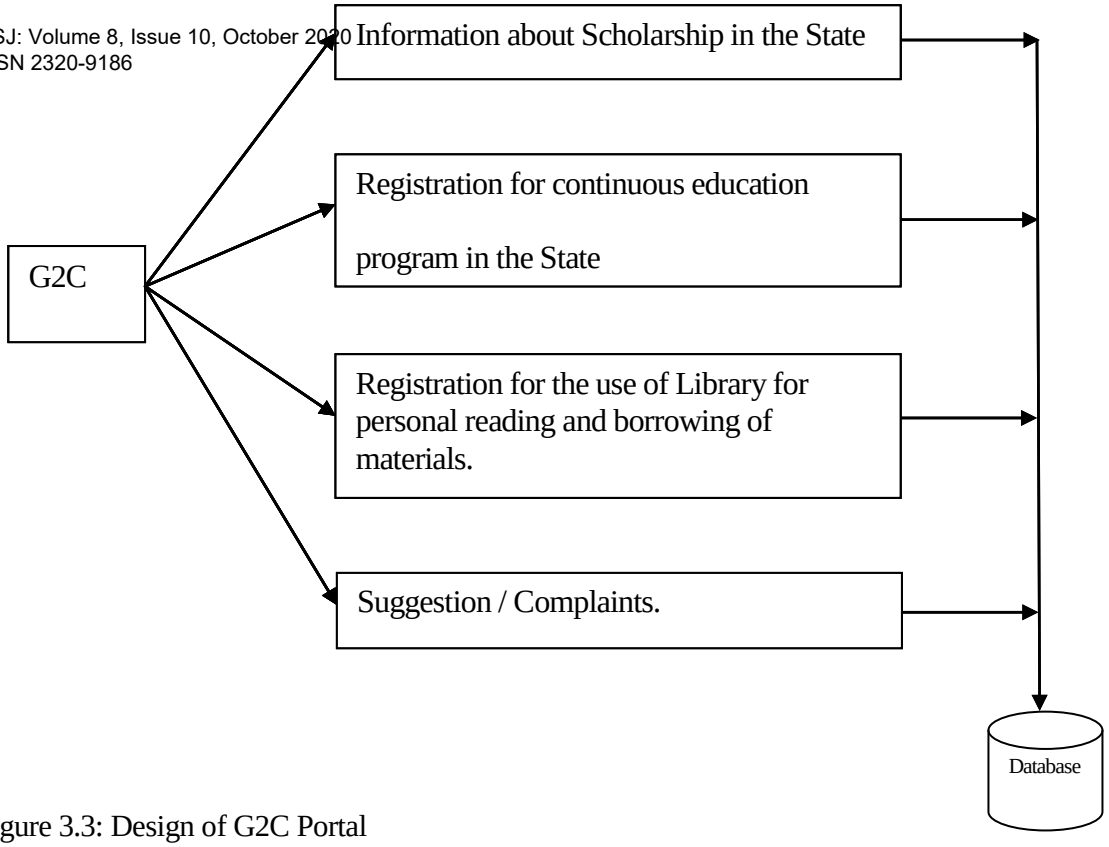
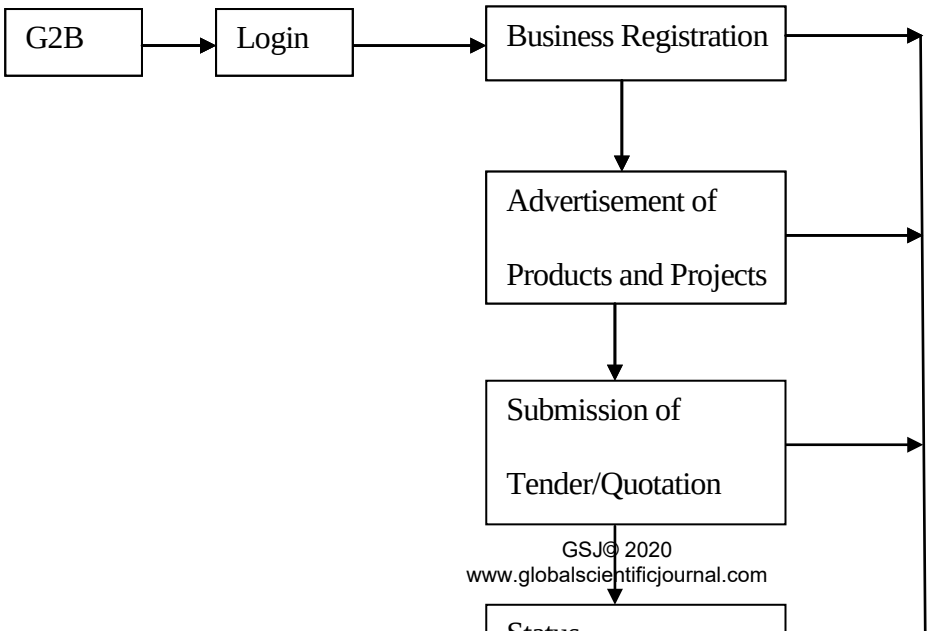


Figure 3.3: Design of G2C Portal

ii) Design of G2B

This portal offer different possibilities for the users interested in transacting business with the Ministry of Education. Status will confirm whether individual or corporate organizations that apply either to supply school f facilities, office equipment, and building structures or renovation work had been approved. When the user login to access the G2B portal, five (5) menu options would be available. The information about available schools' projects (advertisements), provision for the prospective business bodies to register their businesses with the Ministry of Education, medium to check the status whether the project had been approved or not for the applicant, submission of tender/quotation for the project. Finally, is the complaints/suggestions menu.

This information is shown in the figure 3.3.



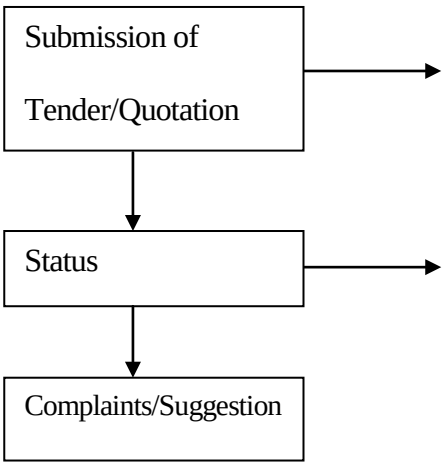
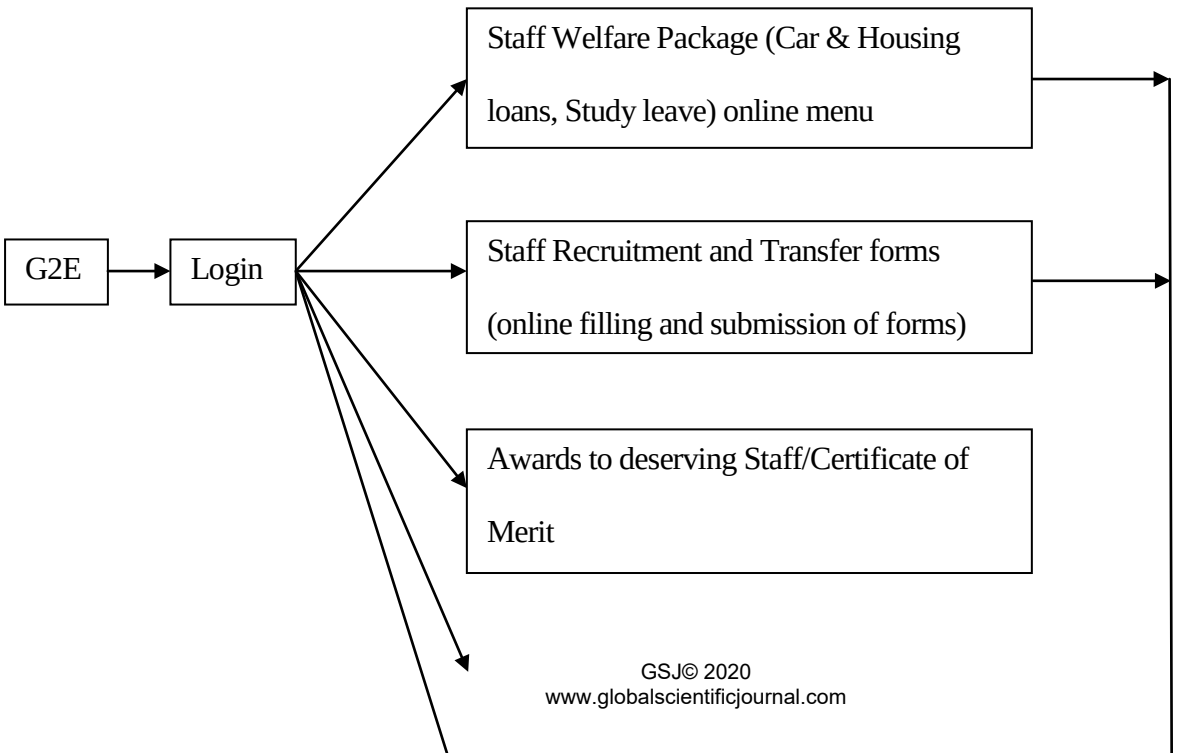


Figure 3.4: Design of G2B Portal

iii) Design of G2E

As the users access this portal, there are four menu options to explore. Information on staff welfare package such as car and housing loans whereby interested staff of the Ministry of Education and the State Public Civil servants can enjoin by filling the form and submit online. Application for study leave form, online filling and submission of employment forms by the applicants seeking for employment into the state ministry of education or the state teaching service commission. Provision to show case the activities of the ministry of education award program for the deserving staff and finally, menu for the feedback. See figure 3.4.



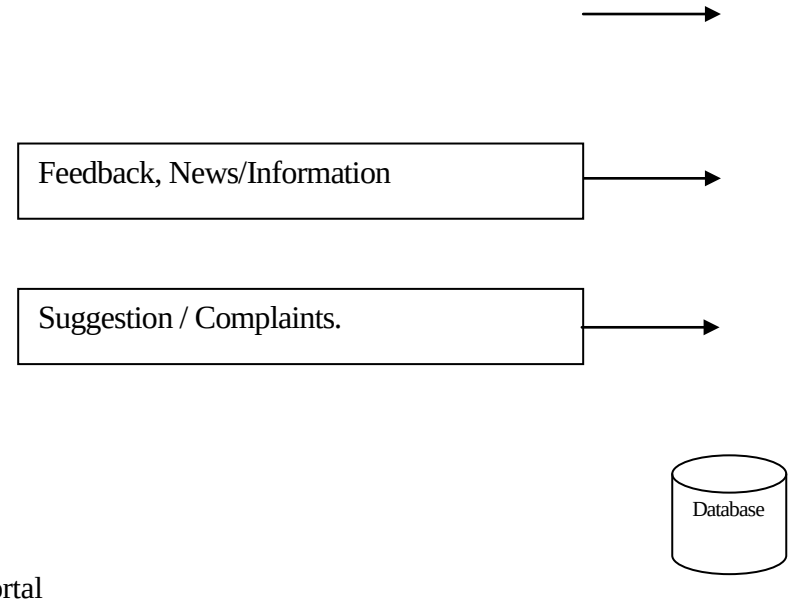


Figure 3.5: Design of G2E Portal

i. **Save Records into the Database:** Enquiry and registrations to access the various portals with other related services offered by the eMMOEST system are stored into the database.

ii. **Processing**: This module is basically responsible for the processing of all enquiry.

iii. **Report Generation** Module: This module is responsible for generating all the required reports.

iv. **Database Backup**: Creating backup of records has become essential to today`s transactions. Backup is a duplicate copy of a program, a disk, or data, made either for archiving purposes or for safeguarding valuable files from loss should the active copy be damaged or destroyed. A backup is an ' insurance' copy.

3.3 DATABASE DESIGN

Database design is crucial to its performance. The database is based on the relational mode which is still

the most widely adopted database model used in most of today's enterprises systems and suitable for the description of our universe of discourse.

As a relational database management system, the conceptual schema is used to describe relations

that are stored in the database. Database design is the process of deciding how to organize data into records types and how the record types will relate to each other. The DBMS mirror's the organization's data structure and process transactions efficiently. This is the process of producing a detailed data model of a database. Principally, and most correctly, it can be thought of as the logical design of the base data structures used to store the data. However, the term database design could also be used to apply to the overall process of designing, not just the base data structures, but also the forms and queries used as part of the overall database application within the database management system.

When designing a database, you have to make decisions regarding how best to take some systems in the real world and model them in a database. This consists of deciding which tables to Create, what columns they will contain, as well as the relationships between the tables. Relational database is made up of relations called a table (Welling et al, 2001).The table has a name, a number of columns, sometimes called fields or attributes, corresponding to a piece of data and rows (records or turples) corresponds to a complete description of a data item. The benefits of a good and functional database that has been designed according to the relational model are numerous. Some of them are;

- Data entry, updates and deletions will be efficient.
- Data retrieval, summarization and reporting will also be efficient.
- Since much of the information is stored in the database rather than in the application, the database is somewhat self-documenting.
- Changes to the database scheme are easy to make.

3.3.1 DATA FORMATTING AND ORGANISATION

After determining the data for the Ekiti State Ministry of Education, Science and Technology (eMMOEST), the data were then formatted and organized into tables. Formatting the data simply involves determining the data type of each data item, whether numeric character, variable character, integer value, etc. In organizing the data, the tabular format was used in which case the data type and size of each data item was indicated and the data were organized into tables.

3.4 DESIGN OF eMMOEST SYSTEM ARCHITECTURE

The system architecture of eMMOEST is aimed at fulfilling the following common software quality requirements:

*extendibility: Based on the goal of the project to be developed, an electronic government system for the Ekiti State Ministry of Education, Science and Technology the system architecture is required to offer possibilities for simple implementations of extensions to the system. Requirements and features are likely to be added or extended in further development cycles.

*flexibility: In a first step of development, single modules of the architecture have to work as stand alone applications for testing and implementing the basic functionalities.

*interoperability: Especially when considering user interfaces of websites, interoperability with different web browsers plays an important role. Besides the importance of this criterion for users accessing eMMOEST, the architecture should also support changes to the import of data and, therefore, offer interoperability as far as the representation of semantic data is concerned.

*maintainability: Further development of a prototype also requires improvements and changes applied to software. To allow developers to easy modification of the software the inclusion of the aspect of "maintainability" to the system architecture is necessary. In general, changes in one part of the software should not require further modifications in any other part of the application.

* portability: In contrast to client-side applications, the prototype depends on the selected web-server application based on the available hardware and on the chosen Database Management System (DBMS). Therefore, the criterion" portability" influences the restrictions of these selections.

***scalability:** As the final number of users was unknown and has not been estimated for the development of the eMMOEST, the system architecture should provide a high level of scalability.

*__security__: Security aspects play an important role. Especially the vast increase of discovered exploits and attacks via the Web in the last decade requires systems and also software to be designed and developed with a strong focus on security.

3.4.1 SYSTEM DESCRIPTION

Based on these general requirements as well as on the prerequisite of separating the user interface from the business logic and the data, the system is divided into four layers, see figure 3.4 below. This separation makes an independent development of the modules possible and facilitates the improvement as well as the replacement of single modules.

*Data Layer: The data layer containing a DBMS or files of any format provides the basis for the system. Consistency, integrity, avoiding redundancy, multi-user access, and security, as well as performance and scalability are of high importance for this layer.

*Access Layer: This layer represents the interface for accessing the data provided by Emmoest. It separates the logic layer from the data layer to facilitate improvements and changes to the data structure and/or type of data storage without the need of changing the business logic.

*Logic Layer: Starting from this layer upwards to the UI layer a division into modules important for import and export is performed. On the import side the logic layer is designed to include functionalities for importing new data to the system as well as deleting or editing data provided by eMMOEST. This layer is highly influenced by the aspects of extendibility, maintainability, portability, and security, as well as performance as most of the processing time of the application will be spent within the logic layer.

* UI Layer (user interface): Similar to the logic layer, the import and export of data are differentiated within the user interface layer. Therefore, a clear separation of the user interface for modifying and accessing the e-Government knowledge is part of the UI layer. On the import-side interoperability is of great importance between the logic layer and the UI layer. On the export-side a high level of interoperability between eMMOEST and various web-

browsers is required.

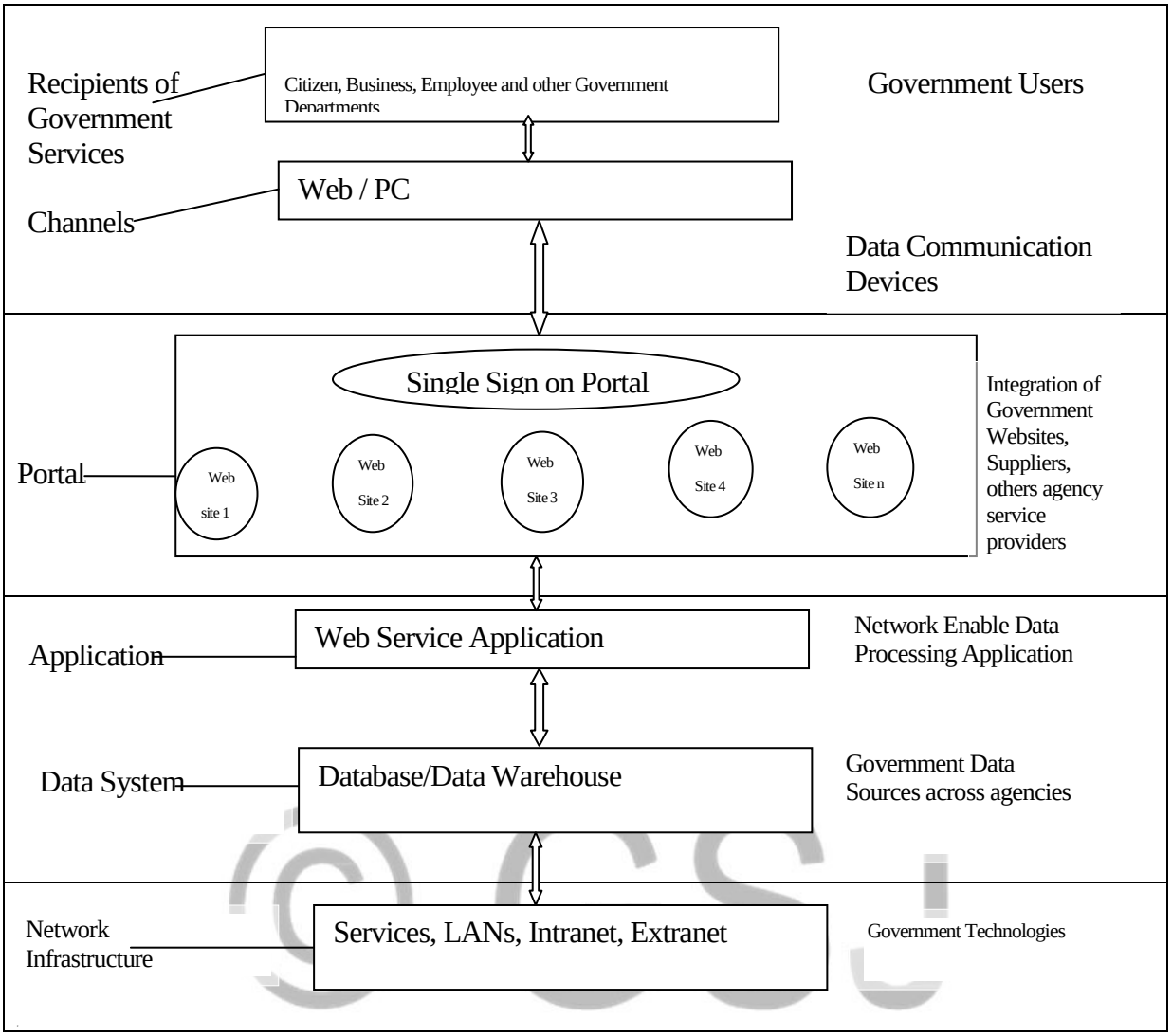


Figure 3.6: Showing the Framework Architecture of eMMOEST.

3.4.2 COMPONENTS OF SYSTEM ARCHITECTURE

Starting from the decomposition of the system into layers, the components and their interactions were identified. By adding hardware as well as execution environments to the identified components, the system was created. The design of the identified components, their behavioral aspects, their final structure, and the selection of the execution environments (web server and DBMS) and the modeling tool are treated separately.

3.4.3 SOFTWARE DESIGN

Besides the selection of the applications and technologies, the design of the implemented software required different approaches. For the development of the business logic an object-oriented approach was chosen.

3.5 SYSTEM OPERATION SETUP

eMMOEST is designed such that it can operate in different operational setups:

i Stand-Alone

This is a computer that is not connected to a network.lt is a system that does not require support from another system.lt allows the database that houses the records and the software package that handles the processing to be installed, configured and made to work on a single computer machine. See figure 3.7

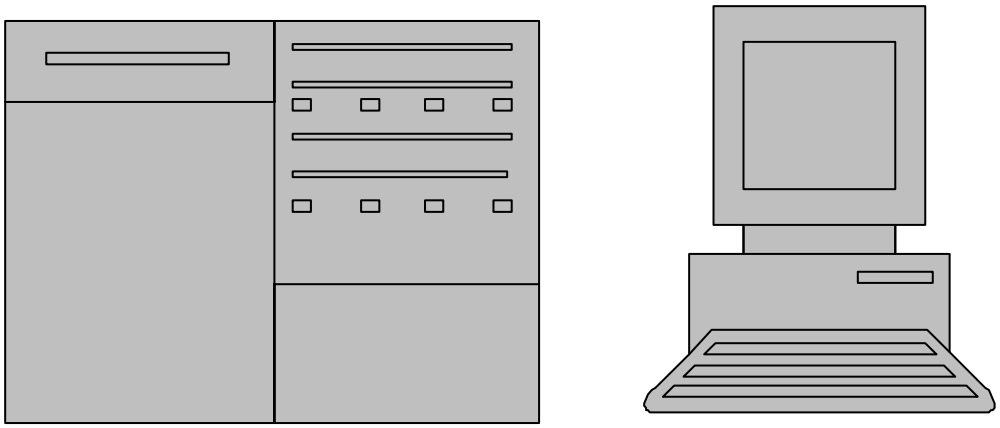


Figure 3.7:Stand Alone System [sourced from Microsoft Clip Art]

ii Client/Server

The client and server machines are connected by a network, as illustrated in fig. 3.5. The network is shown by a simple oval.

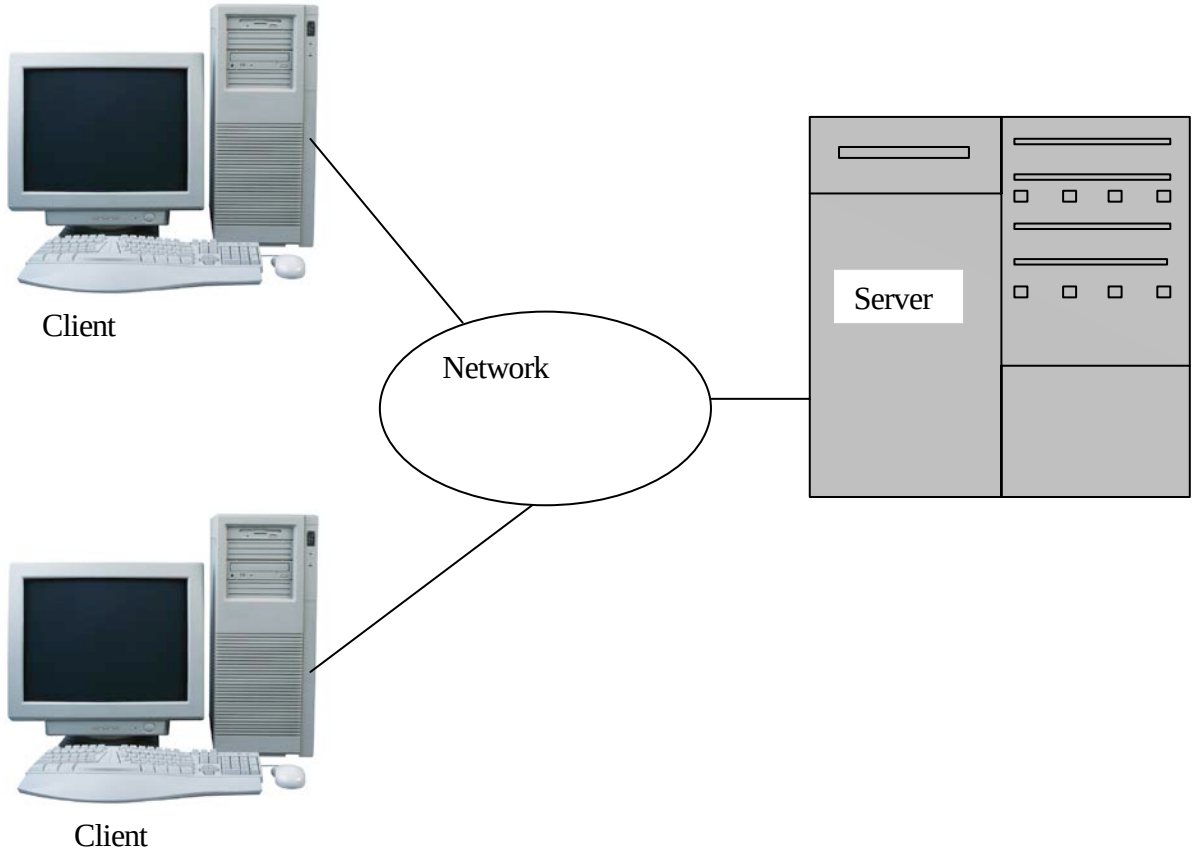


Fig. 3.8: Client and Server [sourced from Microsoft Online Clip Art]

Client-server architecture consists of one or more client applications communicating with another application or service known as the server. A more detailed client-server model has three components:

Service: A service is *a* software entity that runs on one or more machines. It provides an abstraction of a set of well-defined operations in response to applications' requests.

Server: A server is an instance of a particular service running on a single machine.

Client: A client is a software entity that exploits services provided by servers. A client can but does not have to interface directly with a human user.

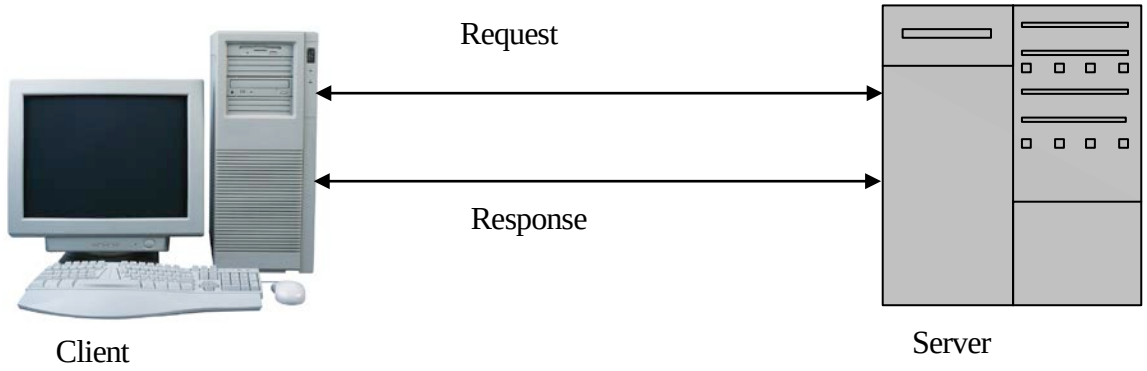
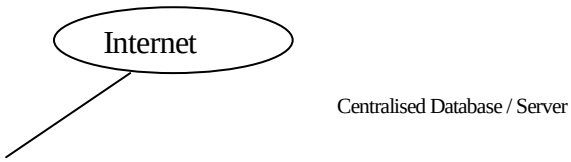


Fig. 3.9: The basic client-server model

iii Client/Server with Distributed Database Operational Setup

A distributed computing system is a set of application and system programs, and data dispersed across a number of independent personal computers connected by a communication network. In order to provide requested services to users, the system and relevant application programs must be executed. Because services are provided as a result of executing programs on a number of computers with data stored on one or more locations, the whole computing activity is called *distributed computing.*

This setup allows each department/ parastatals in the State Ministry of Education, Science and Technology to have its own autonomous database. The database architecture is the same for all the parastatals. A natural model of distributed computing is the client-server model. Distributed computing system can provide the following services: printing, electronic mail, file service, authentication, naming, database service and computing service. See figure 3.10



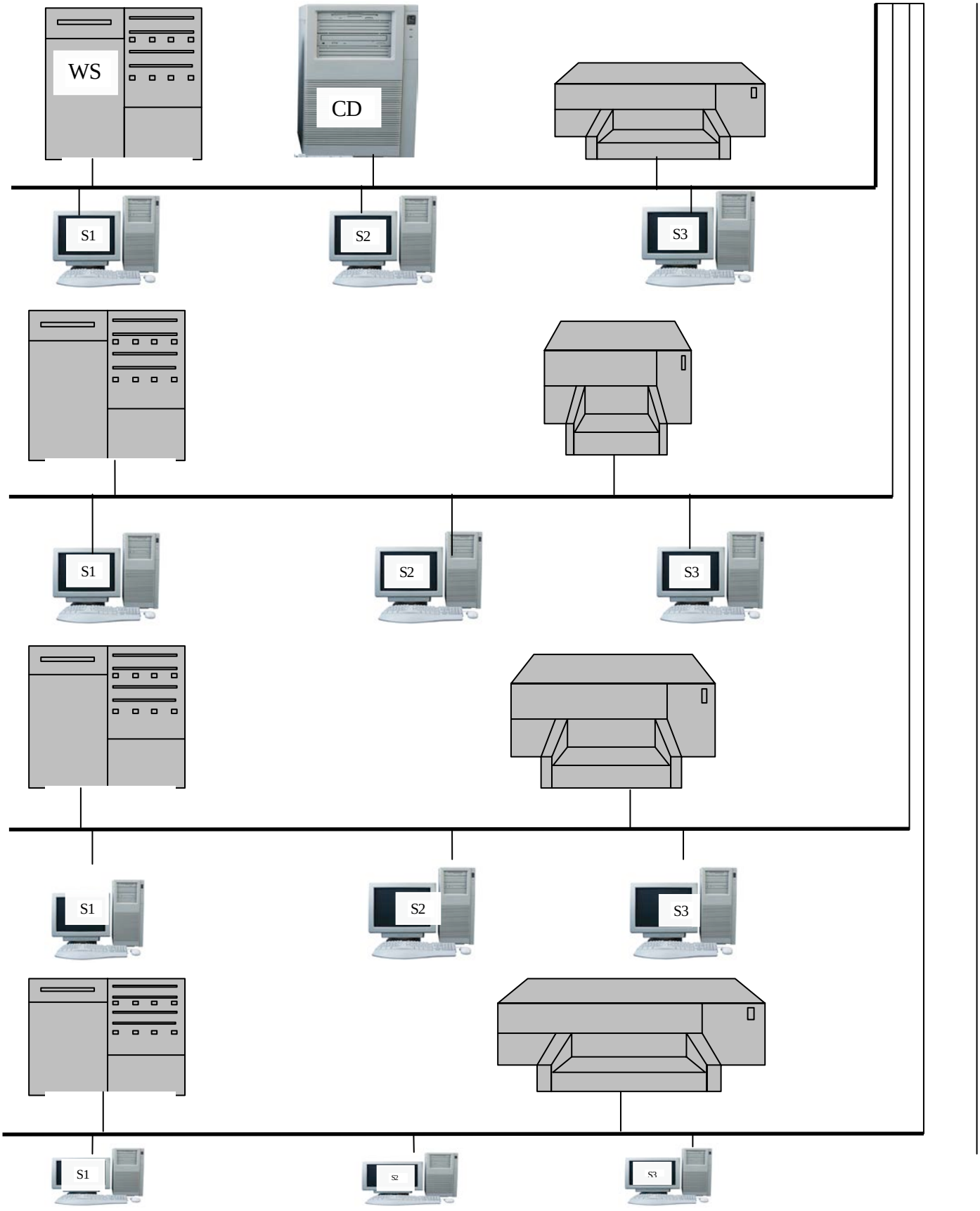


Figure 3.10: Client-Server with Distributed Database.

3.6 USERS' ACCESS CONTROL

An integral part of security management involves restricting access of specified resources to certain entities or objects (Osuagwu, Uwadia 2002).This entails the classification of such objects into levels and arranging the subjects into classes. A subject of a particular class can only view the object that the class has been given clearance for. Clearance is given when the password of the subject matches the corresponding subject identification. On the basis of confidentiality of information security, the subjects - Commissioner, Permanent Secretary and the Executive Secretary, each interacting with their respective objects - citizen, employee, business associate and non-governmental bodies, grouped into the different classes, from which the overall security class will be formed.

Access to protected information must are restricted to people who were authorized to access the information. The login information once created are encrypted such that it is not accessible to the users. The computer programs, and in many cases the computers that process the information, must also be authorized. This requires that mechanisms be in place to control the access to protected information. The sophistication of the access control mechanisms should be in parity with the value of the information being protected - the more sensitive or valuable the information the stronger the control mechanisms need to be. The foundation on which access control mechanisms are built start with identification and authentication. Identification is an assertion of who someone is or what something is. Authentication is the act of verifying a claim of identity. The Username is the most common form of identification and the Password is the most common form of authentication. Usemame and passwords have served their purpose but in our modern world they are no longer adequate.

Usemame and passwords are slowly being replaced with more sophisticated authentication mechanisms. Once Subject, program or computer has successfully been identified and authenticated then it must be determined what informational resources they are permitted to access and what actions they will be allowed to perform (run, view, create, delete, or change). This

is called authorization. Authorization to access information and other computing services begins with administrative policies and procedures. The polices ensure that (access is granted or denied) information and computing services can be accessed, by whom, and under what conditions depending on the security classification assigned to the information resource. The access control mechanisms are then configured to enforce these policies.

4.0 SYSTEM DEVELOPMENT AND IMPLEMENTATION

Microsoft SQL Server 2008 was used for the creation of the database and for the creation of all the tables contained in the database. Microsoft SQL Server was used because of its versatility (possessing ability to be used in many different ways).It can be used on a stand- alone (single computer) setup and it can also be used on a network setup consisting of two or more computers. Microsoft SQL Server 2005/2008 runs on Microsoft Windows operating system platform,e.g MS Windows XP or higher versions such as Microsoft Windows Vista and Microsoft Windows 7. From experience, Microsoft SQL Server 2008 does not perform well on Microsoft Windows XP.

4.1 SOFTWARE TOOL FOR THE IMPLEMENTATION OF THE WEB-BASED SUBSYSTEM.

A team of software was used for the development of the web-based subsystern.PHP (Hypertext Preprocessor) was used as the scripting language.PHP is an open source scripting language used with HTML documents to execute server-side interactive functions.PHP runs on all major operating systems and is primarily used with Linux and UNIX web servers or on Windows servers with add-on software.PHP may be embedded in a Web page and used to access and present database information.

Apache is a free open-source HTTP (Web) server introduced in 1995 by the Apache Group as an extension to and improvement of, the National Center for Supercomputing Applications'

earlier HTTP (version 1.3). Apache is popular on UNIX-based systems, including Linux, and also runs on Windows NT and other operating systems, such as BeOS. Because the server was based on existing code with a series of patches, it became known as " A Patchy server" which led to the official name Apache.

To have Apache running on your system, a light-weight software called WAMP can be installed. WAMP is an acronym for Windows - Apache-MySQL-PHP. Once WAMP has been installed properly and it is set such that it is automatically started when the computer boots, Apache will automatically be running on the system .With this, the web-based system can be ran on the local system which serves as the local host.

4.2 MYSQL FOR DATABASE

MySQL is used to develop the database for this project. The biggest advantage that MySQL has to offer is performance. My SQL is relatively faster than some other database applications such as Postgre SQL (Hunter, 2005). Is a relational database management system that runs as a server. It works on different system platforms. The other reason for using MySQL is that the database design is much simpler in comparison to some other database application. MySQL also allows the creation of web-driven websites with much more ease.

4.3 APACHE SERVER

The Apache server was used for the system. It acts as *a* server that parses files and displays the results when a browser sends out a request for that file. The Apache server has password protected pages so that multiple users can be accommodated by the system. It offers customized error pages and eiTor logs. The main reason for using the Apache server is that it is open source and therefore free. It is compatible with PHP and also offers multi platform support (Glass, 2004).

4.4 JAVA SCRIPT FOR FORM VALIDATION AND CONFLICT DETECTION

JavaScript is a programming or scripting language, which can be embedded in web pages and read by the browser. It can be used to do things such as open a separate browser window, form validation or to display a pop-up message when a certain action is performed by the user (Welling,

2003). JavaScript was used within the PHP files and in separate JavaScript files to provide form validation and conflict detection features in the system.

4.5 LOGIN INTERFACE

The Login Interface contains information for the intending user to register .Through this procedure, users create his or her user's name and password by clicking on SIGNUP.

i) ADMINISTRATOR

Administrator first must SIGNUP to create his or her user account before access can be granted to the information inside the system. Once created; it is encrypted such that it cannot be edited. This ensure adequate security of the information supplied by the users. The confidentiality of the information supplied is guaranteed. This interface is depicted in figure 4.1

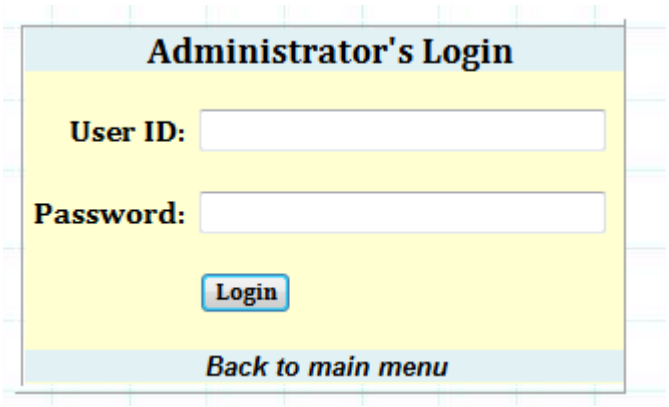


Figure 4.1: Administrator Interface to SIGNUP.

Once an Administrator completed the login process presented in the interface above, the next interface is depicted in figure 4.2 where the various functions to be performed by the Administrator is itemized.

Figure 4.2: Menu options for the Administrator.

Administator, when accessing the ACTIVITIES option can OPEN, CLOSE or APPROVE application.This is where the time for the availability of forms into Remedial Schools, JAMB coaching and Schorlaship is set. Users who subscriped after the set period would not be able to load the form again.

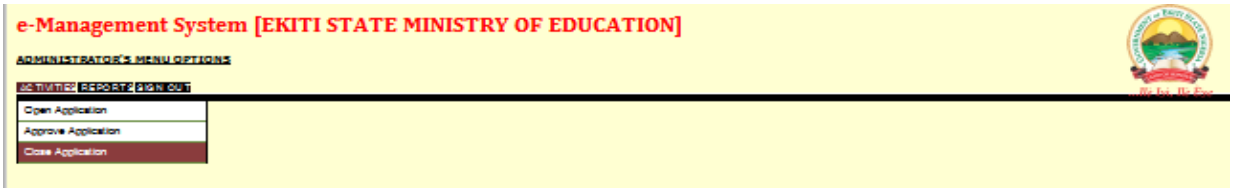


Figure 4.3: Showing Administrator's Menu / Activities.

Report:Adminstrator could access the information supplied by the users through the menu option.Finally can SIGN OUT using the third menu option as shown in the figure 4.4

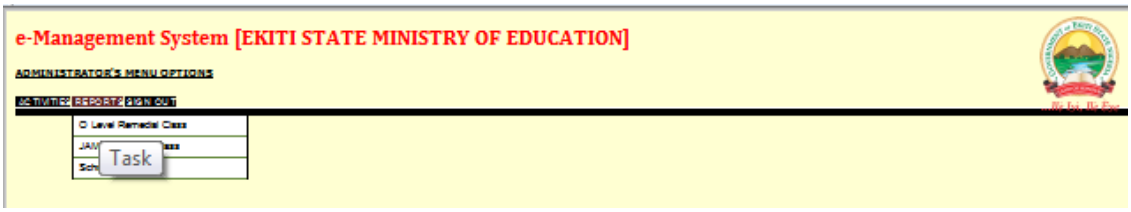


Figure 4.4: Showing the report generation form Interface.

ii) USERS

If valid user's name and password are entered, access is granted and the menu will be displayed depending on the category of the user. The different categories available are Citizens(which may be Ex- Student, Prospective Students seeking for admission into any of the Secondary school in the State, Principals of Schools, scholars applying for the state scholarship, users applying for registration to use the state library), Employees(both state Public and Civil servants in the Ministry of Education applying for loans, transfer from one ministry to another, applicant applying for job online to the State Ministry of Education) and Business (Business partners applying for registration to partake in online registration of students for certificate exams, ordering for products from school enterprise department, etc).Subsequently, users can login with the already created user's id.This interface is depicted in figure 4.5.

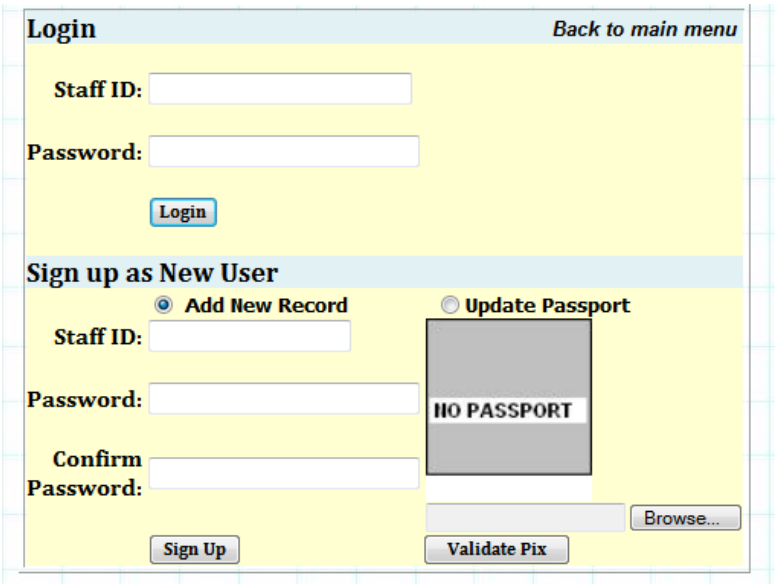


Figure 4.5:Showing users interface for SIGNUP/LOGIN.

Users can update his/her account once discovered that the acount is compromised.This can be done through the interface depicted as figure 4.6.

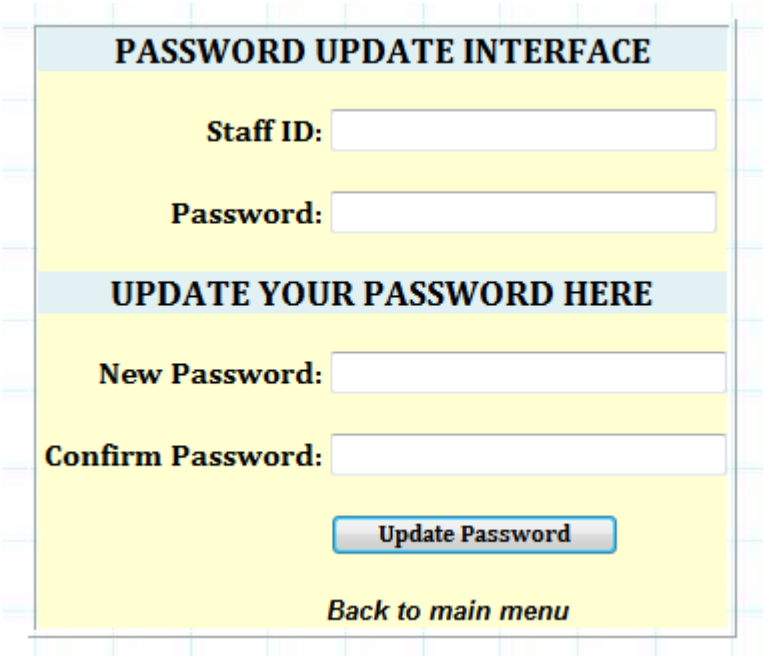


Figure 4.6: Users update interface.

4.6 THE MAIN MENU

The main menu is created using the Multiple Document Interface (MDI) form. It integrates all other user interfaces in the system. It provides appropriate link to all the user interfaces within the system. Each interface has its appropriate code that forms a module, and each module in turn

provides specific solution with a sub-solution within the system.The interface for the Main Menu is depicted as figure 4.7. It comprises of Admin,Employees(G2E), Citizen (G2C), Business (G2B) and School Information menus.

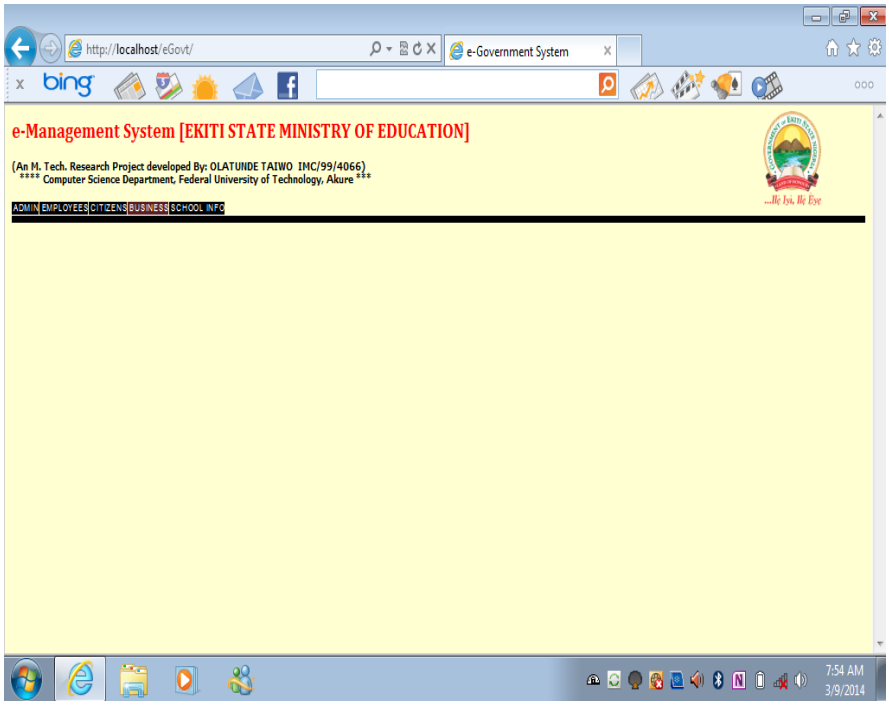


Figure 4.7: Showing the Main Menu.

i) G2E: Staff of the Ministry of Education, Science and Technology from the agencies and Parastaltals considered in this thesis can access the portal with their staff id and password by first clicking on the Employee menu.Then the Login/Signup and Change Password options appeared as depicted in figure 4.8.

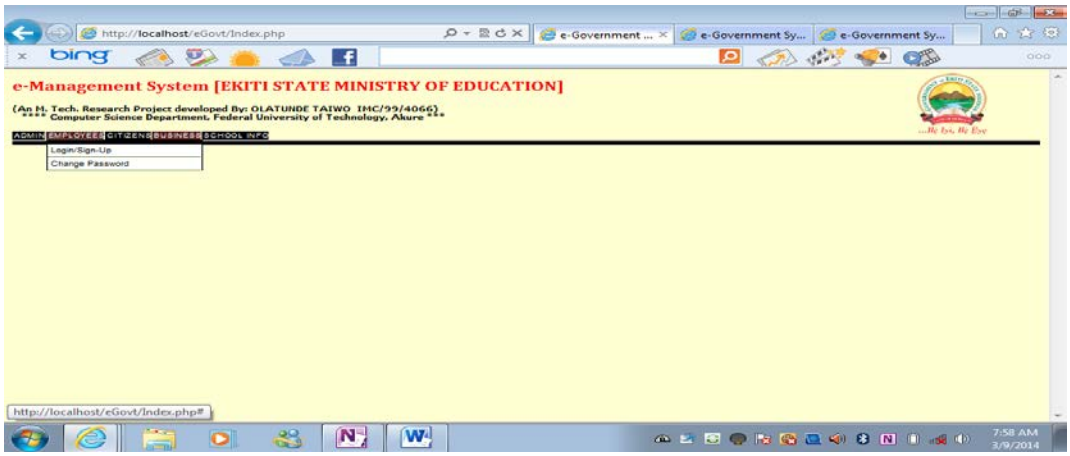


Figure 4.8: Showing the Login/Signup and Change Password options for the Employees.

After signing in, the 'EMPLOYEES' MENU OPTIONS displayed as depicted in figure 4.9.

Figure 4.9: Showing the Employees' Menu Options.

ii) G2C: Majorly, users accessing this portal will be furnished with information about educational system in Ekiti State and enjoy some educational services online viz-a-viz;

a) Students willing to enroll for the remedial coaching classes- JAMB, WAEC and NECO.

b) Students in JSS3, SS1-3 and Ex-Students filling form for the State Scholarship.

c) Students willing to register for the use of State Library.

d) Users receiving feedback for the services requested.

Above stated services are depicted in figure 4.10.

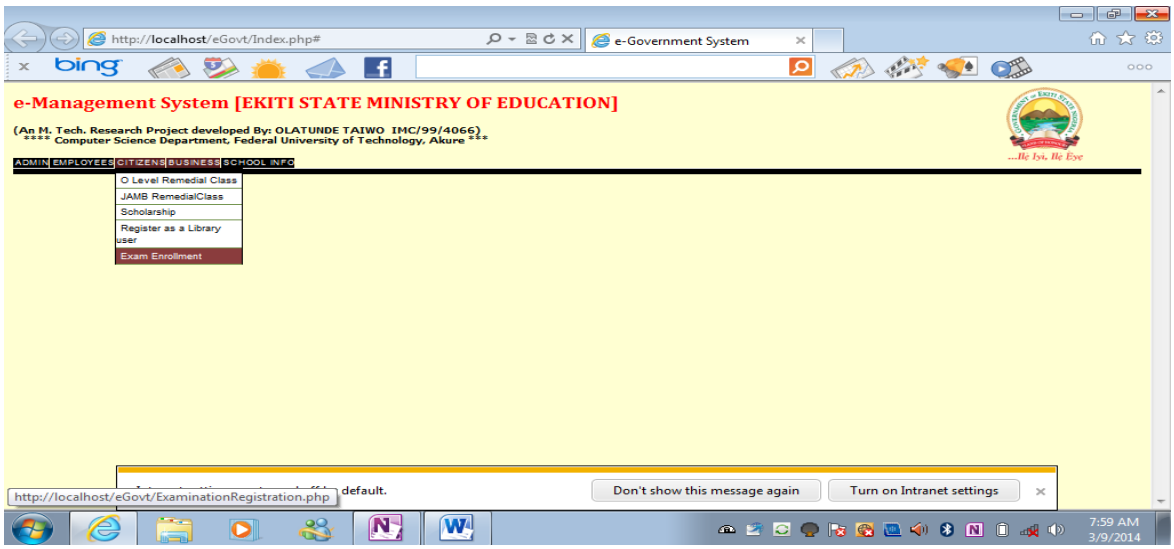


Figure 4.10: Showing the G2C portal.

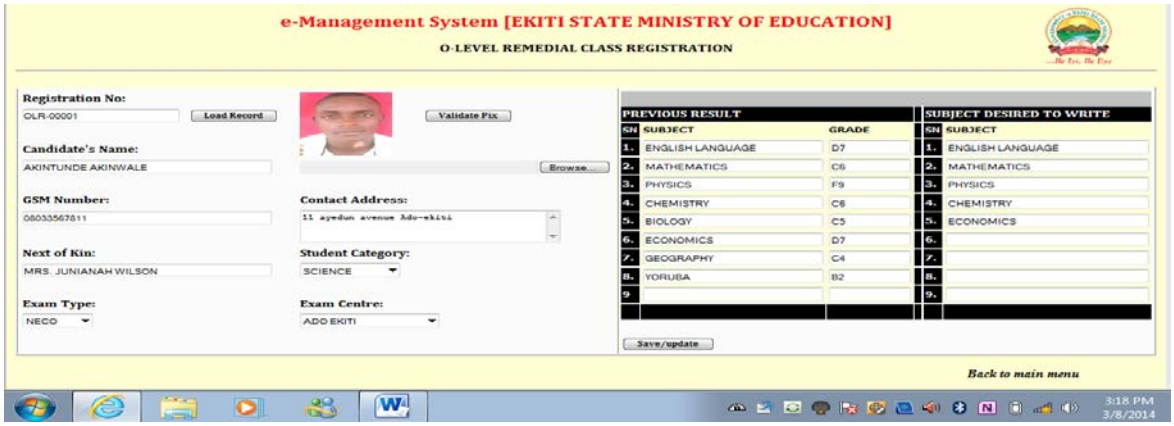


Figure 4.11: Showing example of online user Interface form for Remedial School,centre at Ado Ekiti.

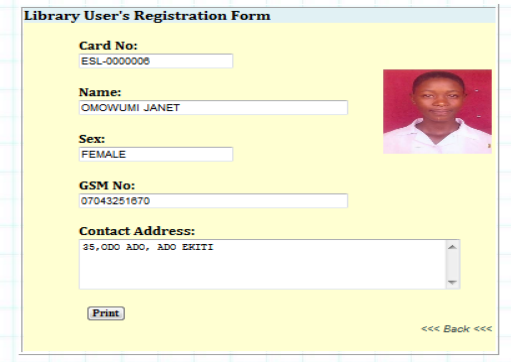


Figure 4.12: Showing online user subscribing for the State Library use.

The card no is automatically generated for a user after a successful login and submission of form.The User later use the card no to produce the Library Card for entrance into the Library.

G2B Interface: Prospectives business men and women accessing this portal to transact business with the Ministry of Education,Science and Technology by clicking on the Business.Users can through the menu find:

a) Online advertisement of products marketed by the School Enterprise Departement.The Schools with their respective products are in the table 4.1 below.

S/N	NAME OF SCHOOL	PRODUCT
1	CHRIST'S SCHOOL,ADO EKITI.	BREAD
2	MARY IMMACULATE GRAMMAR SCHOOL,ADO EKITI	KEY SOAP
3	ADO GRAMMAR SCHOOL,ADO EKITI	TIE & DIE

4	EYEMOTE GRAMMAR SCHOOL,IYIN EKITI	FEED MILL
5	GOVERNMENT SCIENCE COLLEGE,ADO EKITI	SCHOOL CHALK

Table 4.1: showing the schools with their products for sale.

b) E-registration for Business

c) Placing order for the interested goods from the schools

d) Users receiving feedback for the services requested.

Intended Schools can register their product(s) using figure 4.13

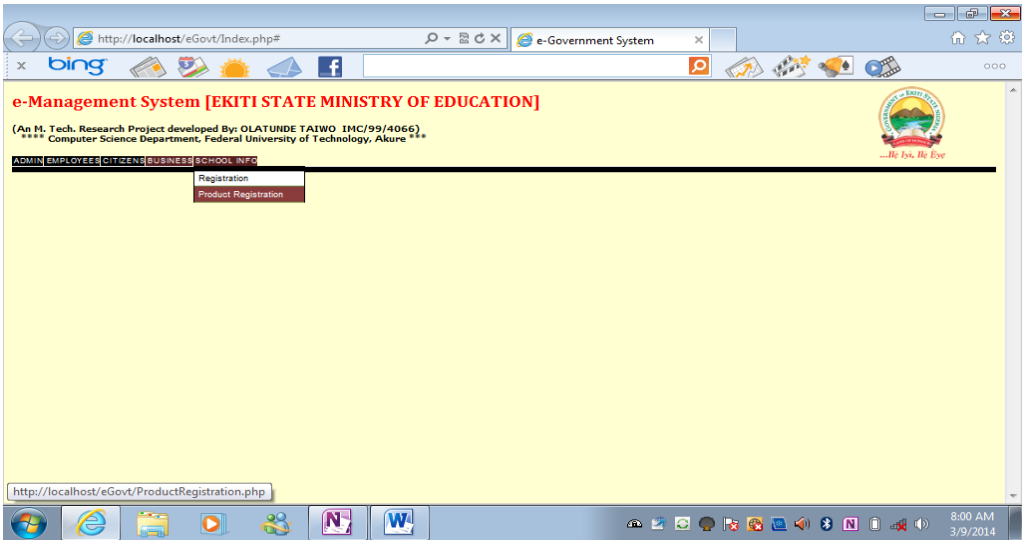


Figure 4.13: Showing the online form interface for schools' to register their product(s) for advartiset.

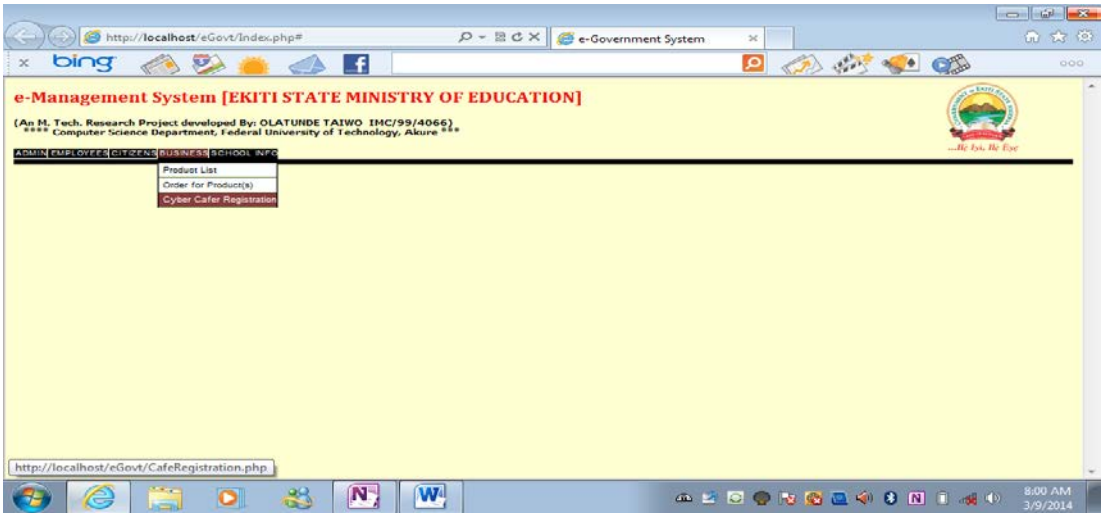


Figure 4.14: Showing the product list,order for product(s) and café registration interface.

The specimen portal for a café registration under the business menu with the Ministry of

Education, Science and Technology for the purpose of WASSCE,NECO and NABTEB online registrations is depicted in figure 4.15.Only the approved café would be eligible to register students from the given schools in the State.

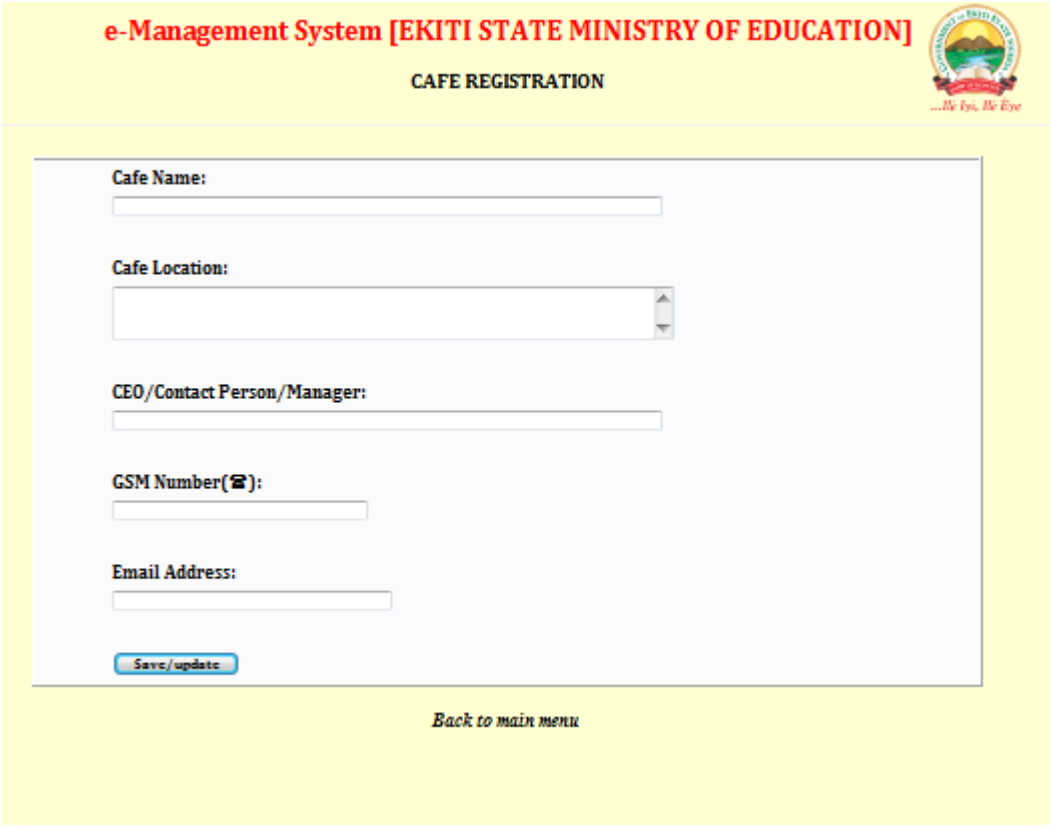


Figure 4.15: Showing the online form for Café owners registration for Business with the Ministry of Education,Science and Technology.

5.1 SUMMARY

A web-based Government Information System is needed for effective administration and proper documentation of employees, students and business associates. eMMOEST is a three-tier application system. Web-browser is the first tier, the middleware engine using some dynamic web content technology such as: common gateway interface (CGI), HYPERTEXT PREPROCESSOR (PHP), JAVA Server Page (JSP), active server pages (ASP). The Controller receives web requests from the web-browser, it decodes the request, instantiate the corresponding model classes and deliver the result of processing to the view and then uses an embedded URL routing scheme to redirect the browser the right page. The database server being the third tier.

Users are distinguished based on the information they have access to. The hierarchy is defined in terms of whether the user is Citizen (G2C), Employees (G2E) and Business (G2B).In the problem domain, the e-Government model is (G2C,G2E, G2B) is the root of the system under which the different departments chosen as a case study of the Ministry of Education, Science and Technology were grouped with respect to their services to the citizen, employees and businesses. The back-end host is a rnysql database servers where database schemas, tables and objects are maintained.

5.2 CONCLUSION

Education is the major industry in Ekiti State. It would be impossible to find a home where nobody is educated; rather, most homes can boast of at least a person with tertiary education. The Ministry of Education, Science and Technology, in collaboration with its parastatals, is charged mainly with the administration of Education in the State. It has the responsibility of implementing all the Education policies and ensures conducive learning environment.

With the help of web-based technologies, governments as well as citizens have efficient possibilities for providing and acquiring information. Based on this clustering, the various parastatals existing in the Ekiti State Ministry of Education, Science and Technology had been grouped into these e-government models: Ministry of Education -to- Central Government (MOEST2G), Ministry of Education -to-Citizen (MOEST2C), Ministry of Education -to-Non-Governmental/Non-Profit Organization (MOEST2NGO/NPO), Ministry of Education - to - Employees (MOEST2E) and Ministry of Education -to-Business (MOEST2B) among others. These likewise, can be identified as types of communication which are part of governmental processes. The centrality of the citizen is the key concept in the provision of e-Government. This means that all citizens who want to must have ready access to these services. It also means that all such citizens must have the ability to use the system and also feel confident using it(mvw.isc.ie/downloads/e-Government.pdf).

eMMOEST system for the Ministry of Education, Science and Technology, Ekiti State would improve internal communication easier for government, parastatals, agencies and people to keep up with what is going on in the State Education Sector and receive accurate information. However, the usage of this ICT driven education portal system will drastically reduce the inefficiencies inherent in manual systems by automating functions and de-skilling routine processes.

5.3 LIMITATIONS

The scope of this research work is limited to some of the education related activities of the Ministry of Education, Science and Technology majorly from these parastatals:

a) Agencies for Adult and Non-Formal Education

b) Teaching Service Commission

c) Board for Technical & Vocational Education

d) Scholarship Board

e) Library Board

f) School Enterprises Board and

g) Education Endowment Board (EEB).

Further research in the future can be extended to the remaining departments/agencis and other ministries.

5.4 RECOMMENDATION

The World has become a global village because everything is now done within seconds through the help of information technology. Citizen, Employees (Public and Civil Servants), Business Partners (with the Ministry of Education, Science and Technology) and Government ably represented by the State Ministry of Education will perform better, get timely information and sending responses in no time at all. In the light of the foregoing, this research work is recommended for use by the State Ministries of Education, Science and Technology in the Federal Republic of Nigeria. I

also recommend further research work including other ministries to be carried out on this project.

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