

Development Of An Online Mineral Resources Management Information System

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Abstract— In this paper, development of an online mineral resources management information system is presented. The main objective of the system is on creating awareness, as well as an avenue for efficient management of mineral resources located all over the country. The online system can also be used as a transaction processing system (TPS) to keep the inventory of minerals discovered and the sales made. Notably, the online system is a web application software, hence, iterative software methodology was adopted in the development. The system was developed using the 3 –tier architecture. Use case diagram of the system and flow diagram of selected key system functionalities were present in the system design. The database design was presented which showed the database table structures and the database entity relation diagram. The web application implementation was achieved with the use of tools like Dreamweaver, PHP, CSS, MySQL and HTML and WAMP software suit. The system was host locally and tested with some sample data. The results are presented using screenshots of selected webpages in the system.

Keywords— Online Software System, Transaction Processing System Mineral Resources Management System, web application, Information Management System

1. Introduction

Mineral resources are important to the economic development of any nation; therefore proper utilization of mineral resources is a demand to both the government and citizen for the growth and progress of the nation [1,2,3,4,5]. The way a nation manages its natural resources will go a long way towards determining the sustainability of its economy [6,8,9,10]. Notably, the 21st century economies are productive because of the effective management of Mineral Resources of the country [11,12,13,14]. For a promising economy like that of Nigeria with all its potentials, it has continued struggle due to mismanagement

and overdependence on crude oil and perennial neglect of other mineral resources. Regrettably, it seems that many Nigerian citizens, more so foreign investors are oblivious of the wealth of Nigeria, in terms of mineral resources coupled with the fact that Nigeria does not have a known viable and comprehensive database for existing mineral resources, which has led to poor foreign and private investment in this sector [15,16,17].

The aim of this paper is centered on providing a web-based awareness platform, as well as an avenue for efficient management of mineral resources located across Nigeria [18,19,20,21]. In view of the foregoing, the guiding principle of the iterative software methodology was adopted whereas implementation was achieved with the use of tools like Dreamweaver, PHP, CSS, MySQL and HTML [22,23,24,25,26,27,28,29,30,31]. Consequently, the system upon completion, created a first-step solution to the problem of mismanagement, by providing a relatively comprehensive database and an avenue for the management of these mineral resources. The software can also be used as a transaction processing system (TPS) to keep the inventory of minerals discovered and the sales made. This will aid investors to know the actual value of the minerals in the nation.

2. Methodology

2.1 The system architecture

The online mineral resources management information system is web application and it was developed using process software development methodology that is both iterative and incremental [32,33,34,35,36,37,38,39,40,41,42]. This management information system is based on a 3-tier web application architecture which is a client-server architectural format consisting of the presentation tier (user interface), program logic tier (server-side scripting) and the data storage (database) [43,44,45,46,47, 48,49,50,51,52, 53,54,55,56, 57,58]. The database is stored on a server on the internet and any client (admin or user) that needs to access the server will access it via a browser. Once the client's browser loads up the home page, the client can click on the required menus and enter the required parameters to query the host server about the mineral resources information e needs. As soon as the server processes the query it sends the information needed to the client. The block diagram of

the system in shown in Figure1 and the 3-tier system architecture is shown in Figure 2.

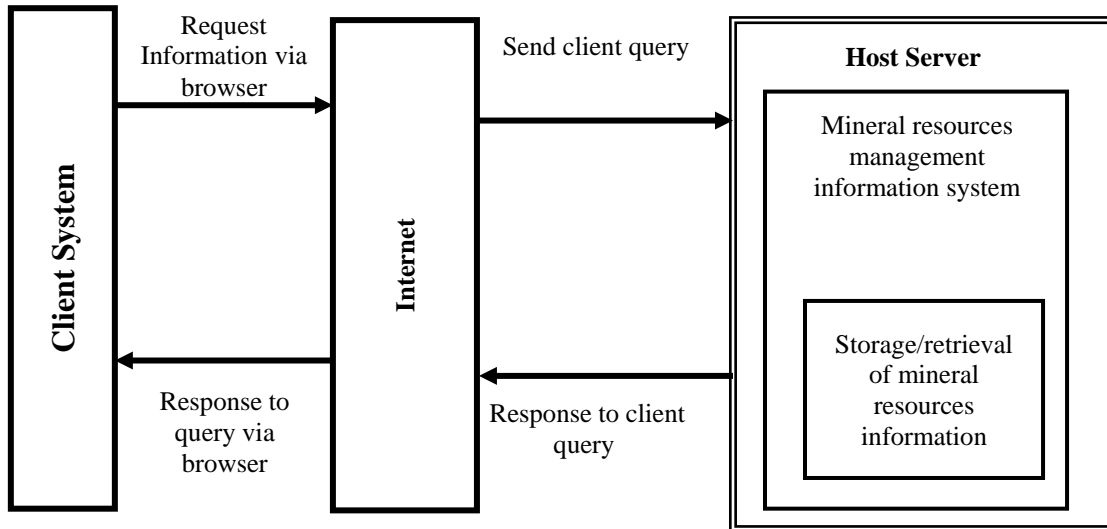


Figure 1 Block diagram of the system

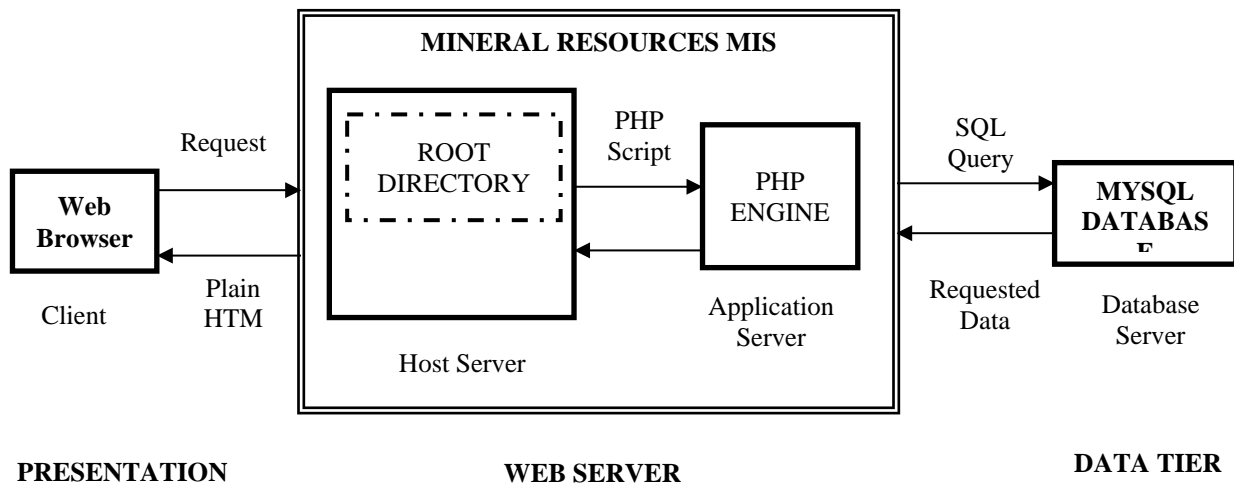


Figure 2 : The 3-Tier System

2.2 The System design

The design of the system is briefly presented using UML use case diagram and flow diagrams. The system has the following modules: Home, Admin, Education, Mine, Mineral, Mine Manager/Employee, Record and Sales, as shown in Figure 3 and Figure 4. The UML use case

diagrams are used to describe the main processes and functionalities of the system. The use case diagram helps to identify the interaction between different users and the system, as shown in Figure 3. The flow diagram for the system is shown in Figure 4.

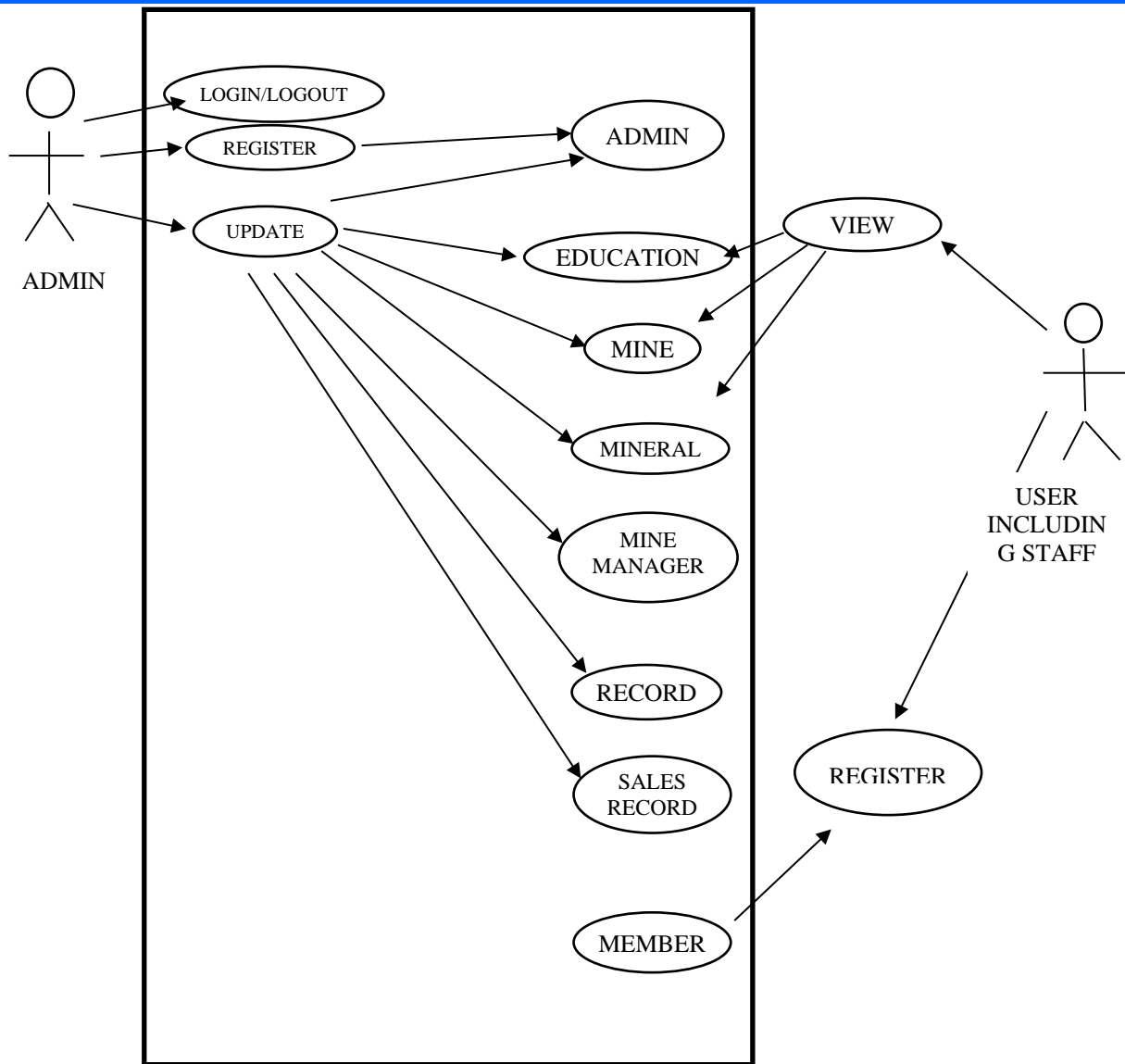


Figure 3 Use Case Diagram of the System

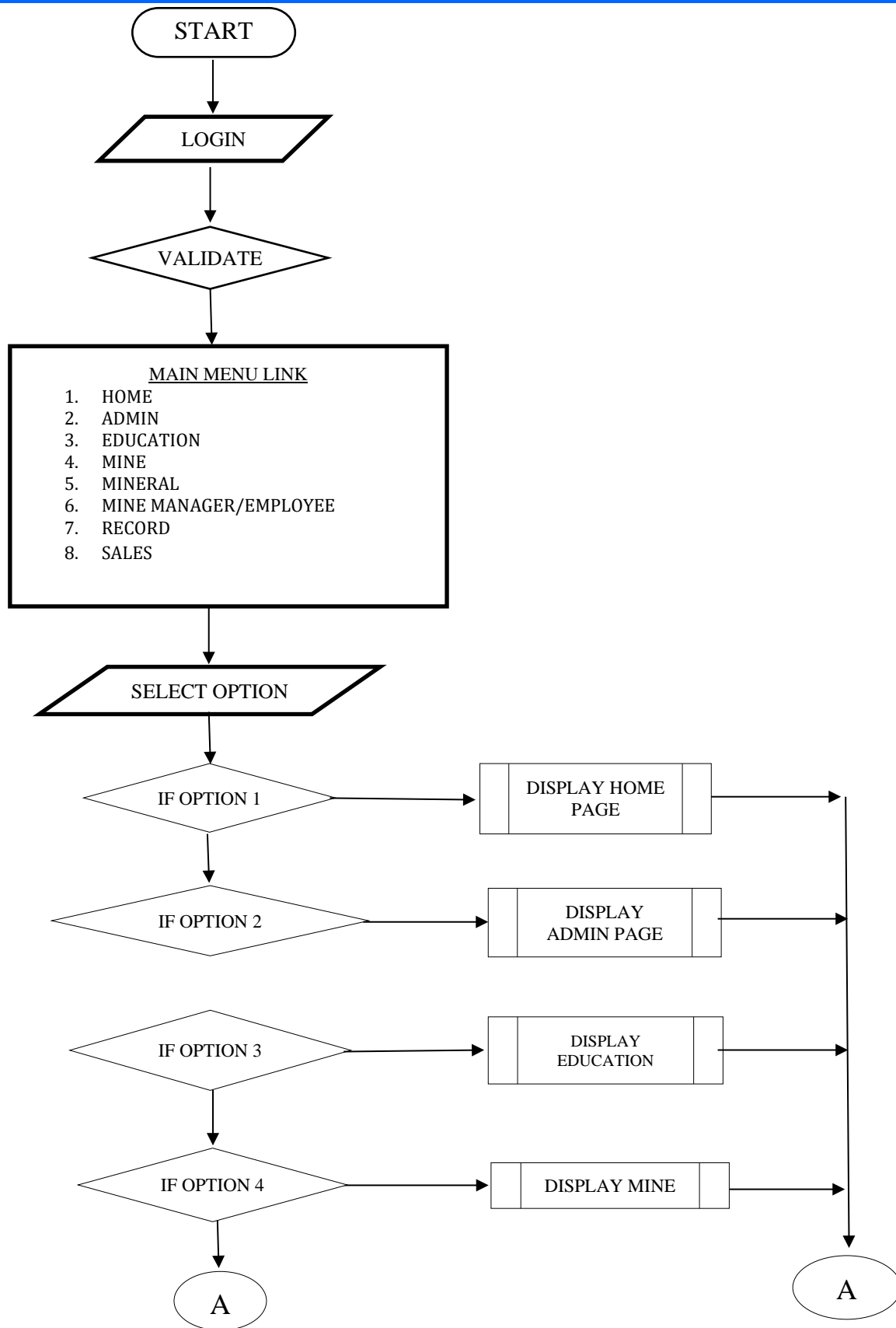


Figure 4a The Admin Flow Diagram

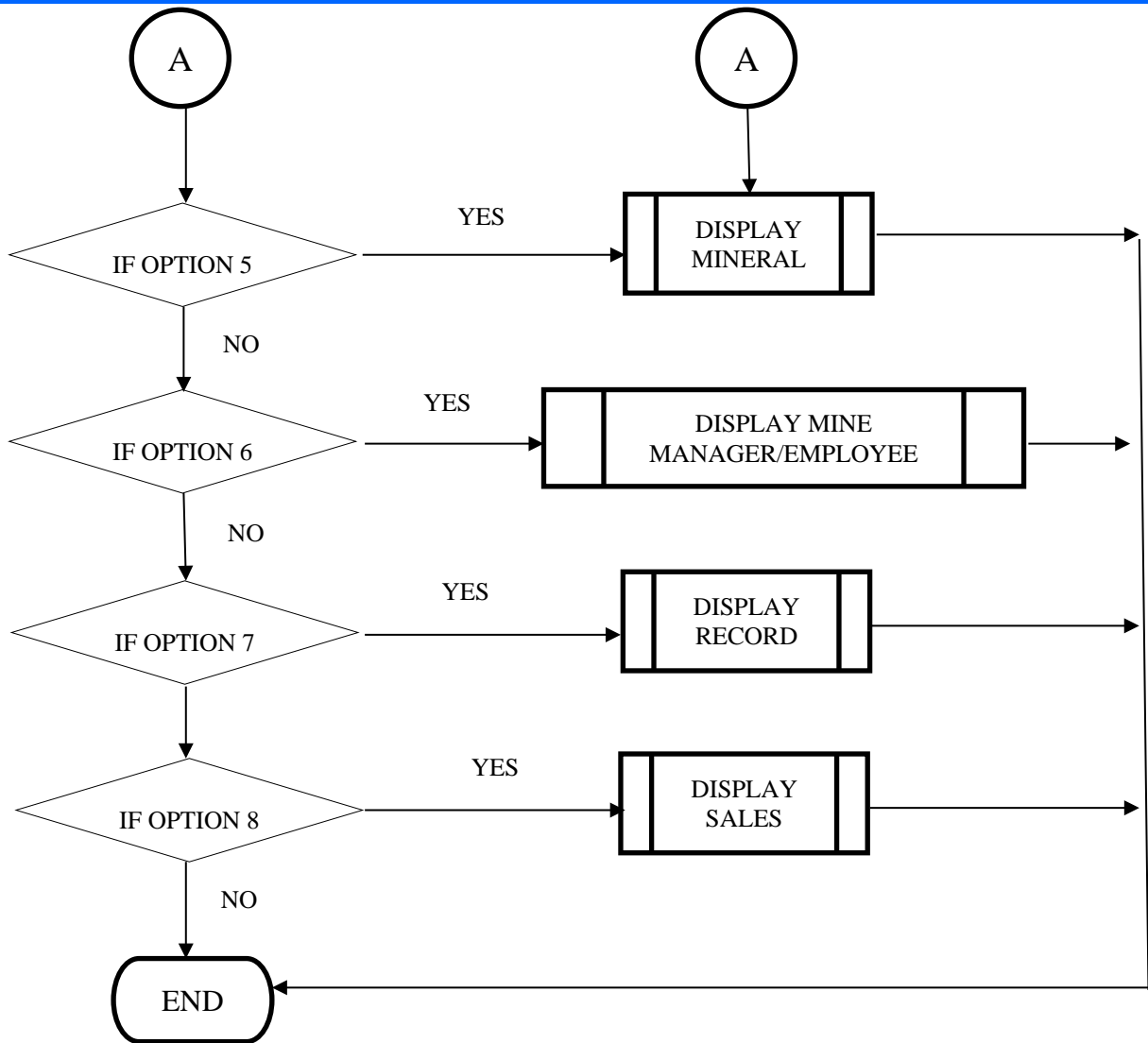


Figure 4 b The continuation of the Admin Flow Diagram

2.3 The System Database Design

The MySQL is use as the database engine for system, hence for data integrity, the database tables are normalized to 4th normal form. Each of the tables has a unique key with which entities are referenced. The database for the information system consists of the following tables; Admin table, Mine table, Mineral table, Mine manager table, Record table, Education table and Sales record table. The

structure of the Admin table is shown in Table 1 while Table 2 shows the structure of the Mine table, Table 3 shows the structure of the Mine manager table and Table 4 shows the structure of the Mineral table. The entity relationship model in Figure 5 shows the connections among the tables that are used in the system database system.

Table 1: Admin table

Column	Type	Null	Default	Extra
Admin_id (PK)	Int(11)	No		Auto_increment
Username	Varchar(20)	No	Null	
Password	Varchar(20)	No	Null	

Table 2: Mine table

Column	Type	Null	Default	Extra
mine_id (PK)	Int(11)	No		Auto_increment
Name	Varchar(20)	No	Null	
State	Varchar(30)	No	Null	
Location	Varchar(20)	No	Null	
Mineral	Varchar(30)	No	Null	
reserves_in_million_tonnes	Int(11)	No	Null	
Status	Varchar(15)	No	Null	

Table 3 : Mine manager table, Table 4: Mineral table

Column	Type	Null	Default	Extra
manager_id (PK)	Int(11)	No		Auto_increment
Mine_id	Int(11)	No	Null	
Fullname	Varchar(30)	No	Null	
Email_address	Varchar(30)	No	Null	
Username	Varchar(20)	No	Null	
Password	Varchar(20)	No	Null	

Table 4: Mineral table

Column	Type	Null	Default	Extra
mineral_id (PK)	Int(11)	No		Auto_increment
Name	Varchar(40)	No	Null	
Estimated_reserve	Varchar(40)	No	Null	
Locations	Text	No	Null	
Property	Text	No	Null	
Uses_and_products	Text	No	Null	
Quality	Varchar(255)	No	Null	
Other_info	Text	No	Null	

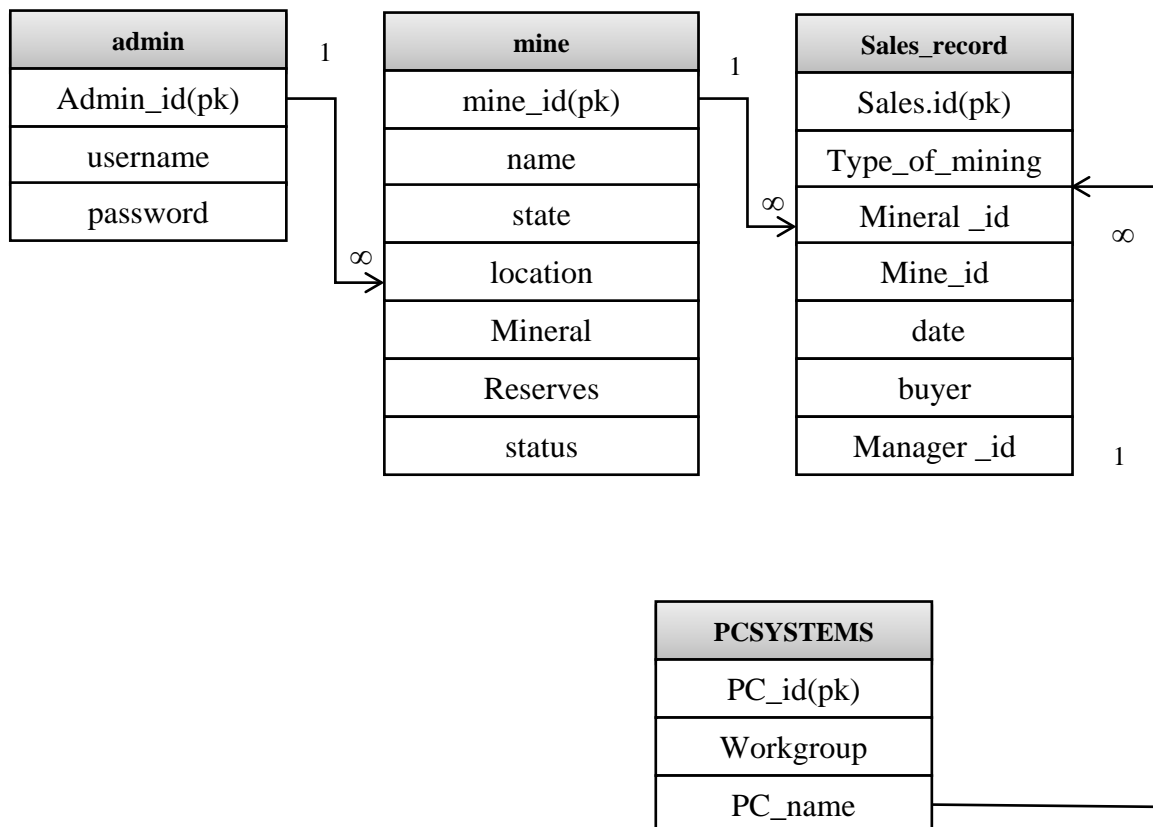


Figure 3: Entity Relationship Model

3 Results and Discussion

The webpage screenshot for the Home page is given in Figure 6. The homepage displays the general information contained in the system and it also provides hyperlinks to the other webpages available in the system. The webpage that is used to educate the general public concerning the available minerals and the different States in which they are present in Nigeria is shown in Figure 7; it is referred to as the Education output page.

The webpage screenshot for Admin login input form is shown in Figure 8. The Admin login input form requires the admin/staff's username and password which gives him/her the ability to have access to the software with which he can update the database. The admin login form which allows the Admin to login is shown in Figure 8. The webpage screenshot of the mine input form is shown in Figure 9. This form is used to collect information about a mine and the information collected include the name of the mine, location of the mine, the State in which the mine is located, the Minerals that are being mined, and its reserves.

Similarly, the webpage screenshot of the minerals input form is shown in Figure 10. This is used to collect information about the minerals present in any location within the country. The information collected include the name of the minerals, the estimated mineral reserves,

locations of the minerals, properties of the minerals, what it is used for and its quality. The managers input form (Figure 11) is used to collect the details and information of the mines managers. The database structure for the mine database structure is shown in Figure 12.

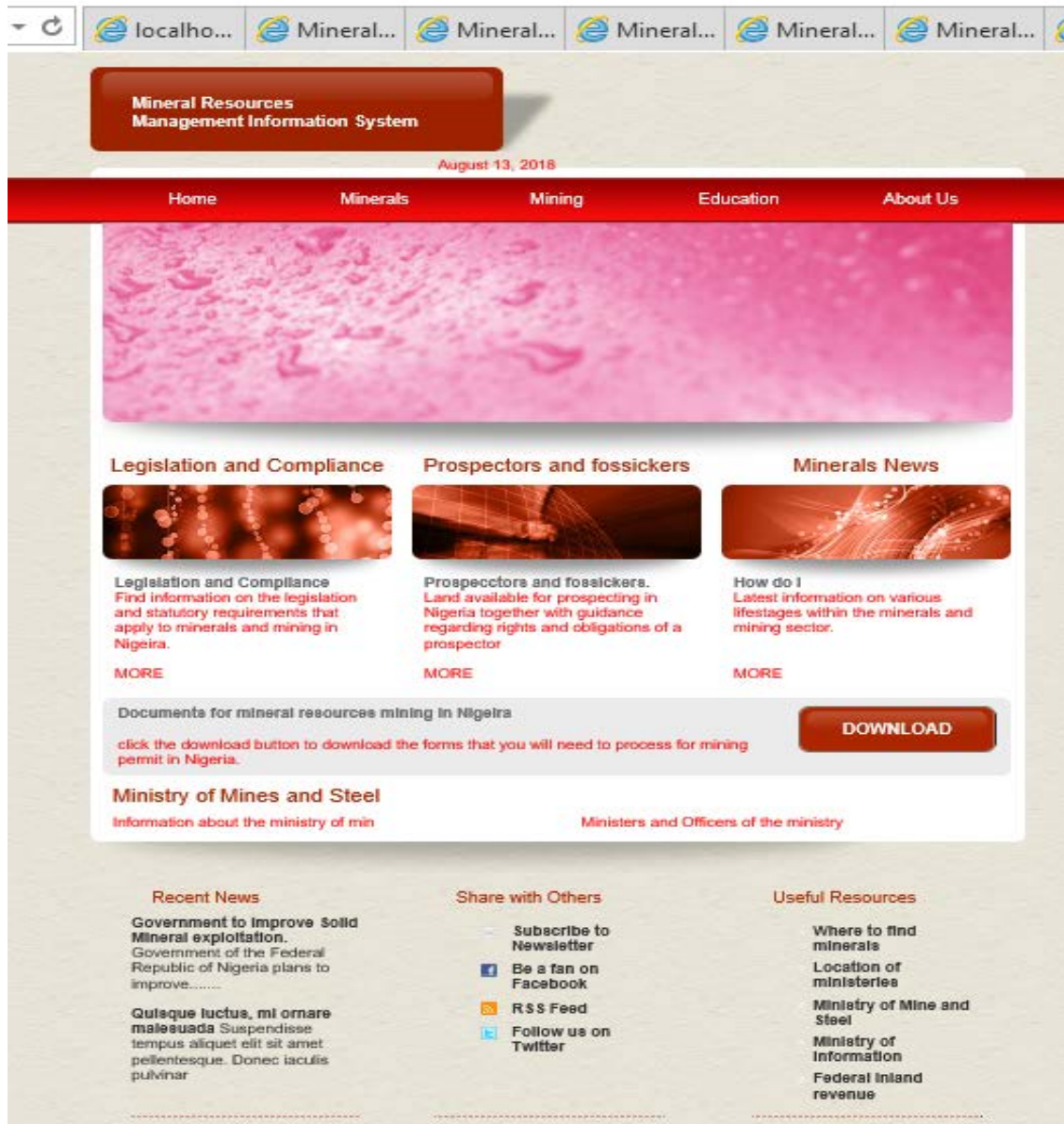


Figure 6 The webpage screenshot for Home page display

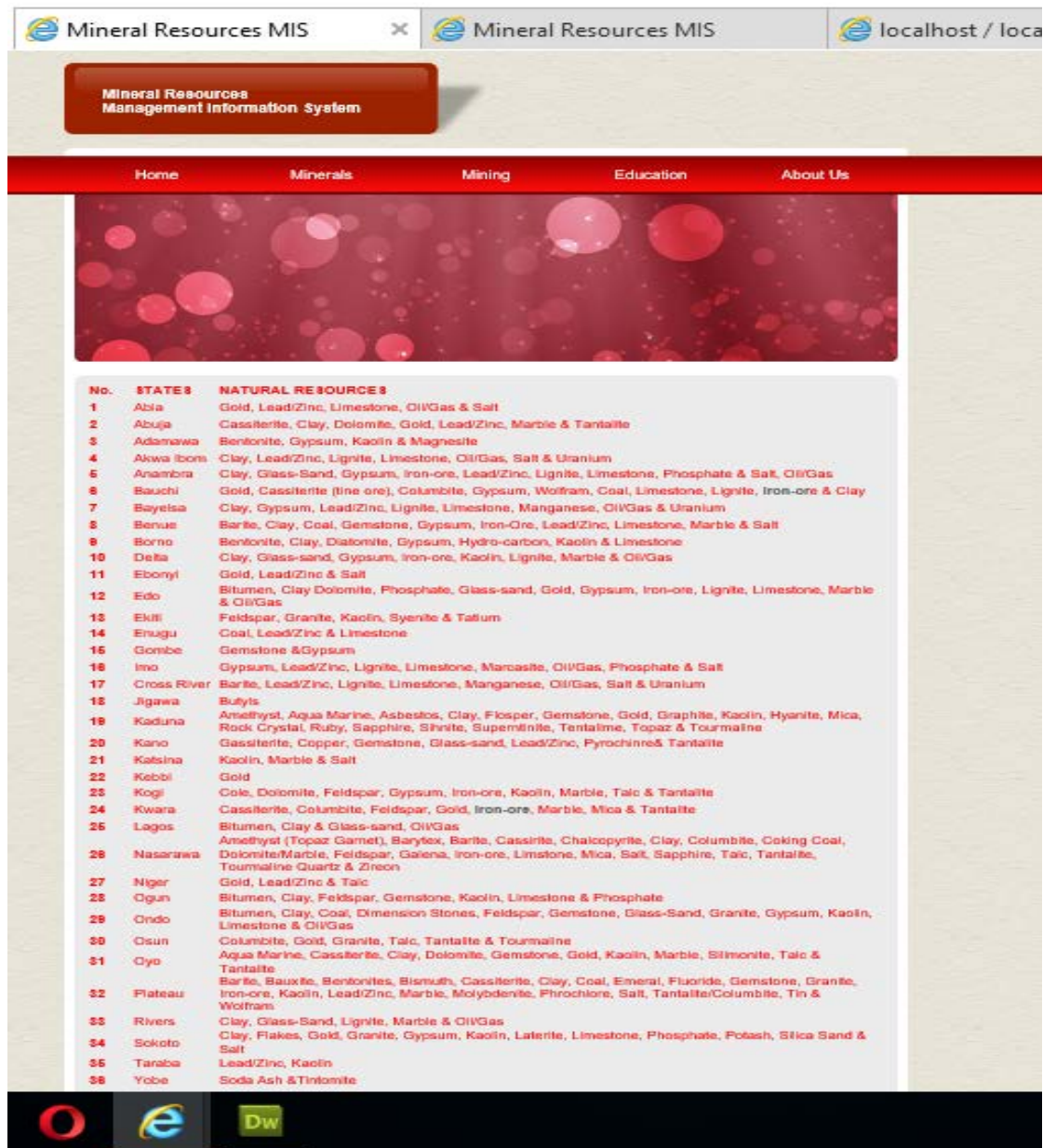


Figure 7 Education output page.

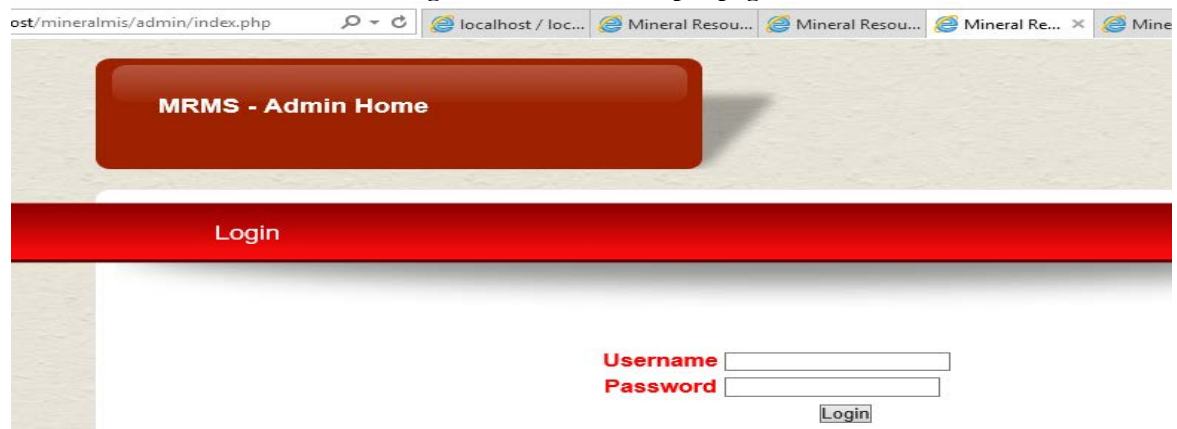


Figure 8 The webpage screenshot for Admin input form

MRMS - Admin Home - Mines

Admin/Staff Minerals Mines Education Records & Sales

Enter Information about the mine and its reserves

Name:

State:

Location:

Mineral:

Reserves: in millions of tonnes

Status:

Figure 9 The webpage screenshot for Mine input form

MRMS - Admin Home

Admin/Staff Minerals Mines Education Records & Sales

Enter the minerals available in the country

Name:

Estimated reserve:

Locations:

Property:

Uses of products:

Quality:

Other information:

Figure 10 The webpage screenshot for Minerals input form

MRMS - Admin Home - Managers

Admin & Staff Minerals Mines Education Records & Sales

Enter names of managers of the mines

Mine ID:

Full name:

Email address:

Username:

Password:

Figure 11 The webpage screenshot for Manager Input form.

Table	Action	Records	Type	Collation	Size	Overhead
admin		1	InnoDB	latin1_swedish_ci	16.0 KiB	-
education		3	InnoDB	latin1_swedish_ci	16.0 KiB	-
mine		1	InnoDB	latin1_swedish_ci	16.0 KiB	-
mineral		2	InnoDB	latin1_swedish_ci	16.0 KiB	-
mine_manager		4	InnoDB	latin1_swedish_ci	16.0 KiB	-
record		3	InnoDB	latin1_swedish_ci	16.0 KiB	-
sales_record		0	InnoDB	latin1_swedish_ci	16.0 KiB	-
7 table(s)	Sum	14	InnoDB	latin1_swedish_ci	112.0 KiB	0 B

Figure 12 The webpage screenshot for mine database structure

4. Conclusion

The web application that can be used to document and publicise the mines and minerals located all over the country is developed and tested with some sample data. The system was developed using the 3 –tier architecture. The system use case diagram is presented along with the flow diagram of selected key system functionalities. The database tables and their table structures are also presented. The system was implemented using WAMP software suit which includes Apache web server, MySQL database manager and PHP scripting language along with Windows operating system. The system was host locally and tested with some sample data.

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