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DEVELOPMENT OF A ROBUST PHARMACY MANAGEMENT SYSTEM USING WATERFALL SOFTWARE ENGINEERING MODEL

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ABSTRACT

This project presents a design and implementation of a Robust Pharmacy Management System using the Waterfall Software Engineering Model. This work aims to reduce the problem of having a system whereby, only the Administrator has the advantage of using the Pharmacy system, and also, to solve the problem of having customers travel all around before getting their desired drug(s). Also, to improve accuracy, enhance safety and promote interaction between Pharmacy stores and individuals (customer). Today management is one of the most essential features of all forms. Management provides sophistication to perform any kind of task in a particular form. This is the pharmacy management system; it will be used to manage most pharmacy-related activities in the pharmacy as well as being an intermediary between Pharmacy stores and the customers. This design was developed using the waterfall model. Hypertext Pre-processor (PHP) programming language, Hypertext Mark-up Language (HTML) and Cascading Style Sheet (CSS) was used for designing the frontend and SQL as a backend database technology. This design is an integrated system that encompasses the Pharmacy Management System and Online Pharmacy System. It is a website that serves as an interface for the Pharmacy stores and the customers, in which the staff (Pharmacist) and individual customers will be able to access Pharmacy stores available within their locality; easily and at the same time customers will be able to access information about drugs in each store. This will make the work of the Administrator and the Pharmacist easier by keeping the data (drug information, staff record management, drug inquiry, and so on) and allocating them automatically.

Keyword: *Hypertext Preprocessor (PHP) programming language, Hypertext Mark-up Language (HTML) and Cascading Style Sheet (CSS)*

INTRODUCTION

Due to the size and quality service of the pharmacy, the pharmacy has a very large customer base. These customers tend to visit the pharmacy for services mostly when they close from work. At this period, the number of customers that patronize the pharmacy is on the increase, thereby making the workload of the pharmacists much more tedious. This case makes it difficult for the pharmacist to attend to customers in a short period.

Meanwhile, the pharmacist has to ensure satisfaction in services to keep their customers. The factors mentioned above results in delay of the services being rendered to the customers, thereby slowing down sales and risk losing valuable customers in the long run.

This project is developed to reduce the problem of having a system whereby, only the Administrator has the advantage of using the Pharmacy system, and also, to solve the problem of having customers travel all around before getting their desired drug(s). Pharmacy management has kept the paper record in filing cabinets. Managing a very large pharmacy with records on papers was tedious and difficult to keep track of inventories with regards to the drugs in the store, expiry date, quantity of drugs available based on the categories and their functions. Drugs are not supposed to be used after they have expired. This project work will prompt the pharmacist about drugs that are close to expiry, preventing those drugs from being sold and also providing solutions to the earlier stated problems.

2.1 Overview of the Pharmacy Management System

The pharmacy systems are considered as computer systems which are used for managing and storing the medicines in a pharmacy. These systems were replaced by manual systems with high efficient functions; such as stock management and control, medicine labeling and so on; knowing the medication history of the patient and supporting the process of hospital pharmacy (Gimbar, Renee, & Jennie, 2017).

Pharmacy Management System, or shortly PMS, is a complex computer system that was designed to meet the needs of a pharmacy department. The use of such systems will give the power to the pharmacists to supervise and directly affect the use of medication in hospitals. Pharmacy Management Systems was initially designed to manage the immediate business and efficiency needs of the pharmacy, especially the rapidly growing data requirements of unit dose systems (Evans & Howe, 1971; and Derewicz & Zellers, 1973). Some of the key features of early Pharmacy Management System included pharmacy billing (Fish, 1979), inventory management (Winters & Hernandez, 1972), and report generation consisting of medication labels (Souder, Gouveia, Sheretz, Zielstorff, Jones & Barnett, 1973), fill lists, and patient profiles (Souder et al, 1973; Freund, 1973; and McGovern, 1981). More modern functionalities, such as those that support clinical pharmacy activities, would be addressed later (Chamberlain, 1982, and Ryan, Rinke & de Leon, 1995). Since vendors of early integrated CISs were not sufficiently agile to compete with the robust functionality of Pharmacy Management System developed for inpatient pharmacy practice, many

hospitals elected to purchase a "best-of-breed" mainframe-based or stand-alone pharmacy information system were all using conventional purchasing processes, such as the request for proposal (Ryan, Rinke & de Leon, 1995; Puckett, 1982; Coblio, 1984; Neal, 1993; and Saya, & Shane, 1995).

Carlisle (2012) presented in his book; different algorithms with rich information about issuing drugs and monitoring and controlling patient.

Nurul (2010) proposed a Drug Management System (DMS) that increase the stocktaking management process. The proposed system is equipped with an alarm that alerts the admin about all medicines which have reached the minimum quantity and medicines that have expired.

2.2 Problems of Existing System

Having observed the existing system (Manual Pharmacy) thoroughly, the existing manual Pharmacy is still facing a lot of challenges which is indicating that it is time to migrate to Pharmacy automation. Some of the challenges includes; Time Wasting, Loss of Data, Loss of Pharmacy materials, Inadequacy of personnel and Biasness. So, adequate manpower is extremely needed for proper functioning of a pharmacy (Alomi, 2016). Besides, the management of the paper-based services faced several complications in specific directions that can be summarized in time-consuming accessibility, managing the store as well as searching for a qualified staff that can match the requirements of employer expectations (Wheeler, Ngo, Cecil & Borja-Hart, 2017). In other word, most of time are lost in tracking, matching or storing documentation in manual procedure (Goundrey-Smith, 2013). Applying digitalized and modern hospital pharmacy, the health sector can be improved dramatically (Basher & Roy 2011).

2.3 The Present Day Pharmacy

Anderson (2005), the modern drugstore varies significantly from its ancient counterparts. While the proprietors of pharmacies in the far distant past were often making numerous medical decisions - diagnosing and treating patients without the consultation of physicians - pharmacists in the modern drugstore are tasked instead with the responsibility of evaluating the appropriateness and managing the dispensation of pharmaceuticals prescribed to patients under a doctor's care. Among the most important role of a pharmacist, assuring that the patient of not prescribing two drugs at the same time, is very essential because, this will cause an adverse interaction. Making Medicines is a concise, chronological discussion of the history of therapeutics and pharmacy from the Egyptians through to the present day (Anderson, 2005). An in-depth study of pharmacology is required to make such evaluations and in all states such positions are highly regulated and require testing before the issuance of a pharmacist's license.

Far from being just a clerk behind a counter, pharmacists also play a role in disease management and evaluation of test results. In developed countries, pharmacies are mainly supervised and serviced by clinically experienced graduate pharmacists (Simpson, 2017). In hospitals, pharmacists are often in the role of interpreting chemical signatures in complex test results and advising physicians on treatment options as well as making doctors aware of new and possibly more effective drugs. Besides, the information technology makes us master the whole hospital drug use situation and achieve the goal of effective monitoring and scientific supervision on clinical medication (Qingyuan & Yanhong, 2008).

Many people interested in a career as a pharmacist have found that in recent times it is a quite reliable profession in times of economic hardship. Earnings for professional pharmacists continue to rise while the industry for new and returning workers is quite robust. Furthermore, Hospital pharmacies that are owned by the government have little or no problems with financing projects due to backing from the government (El Tayeb, n.d.).

METHODOLOGY

Database design

This is a shared collection of data that are related or files that are to meet the immediate need of authorized users. These data may be in the form of text, numeric, date or encoded images.

Figure 1 gives an Entity- Relationship diagram of the database structure, and how the tables are related to one another.

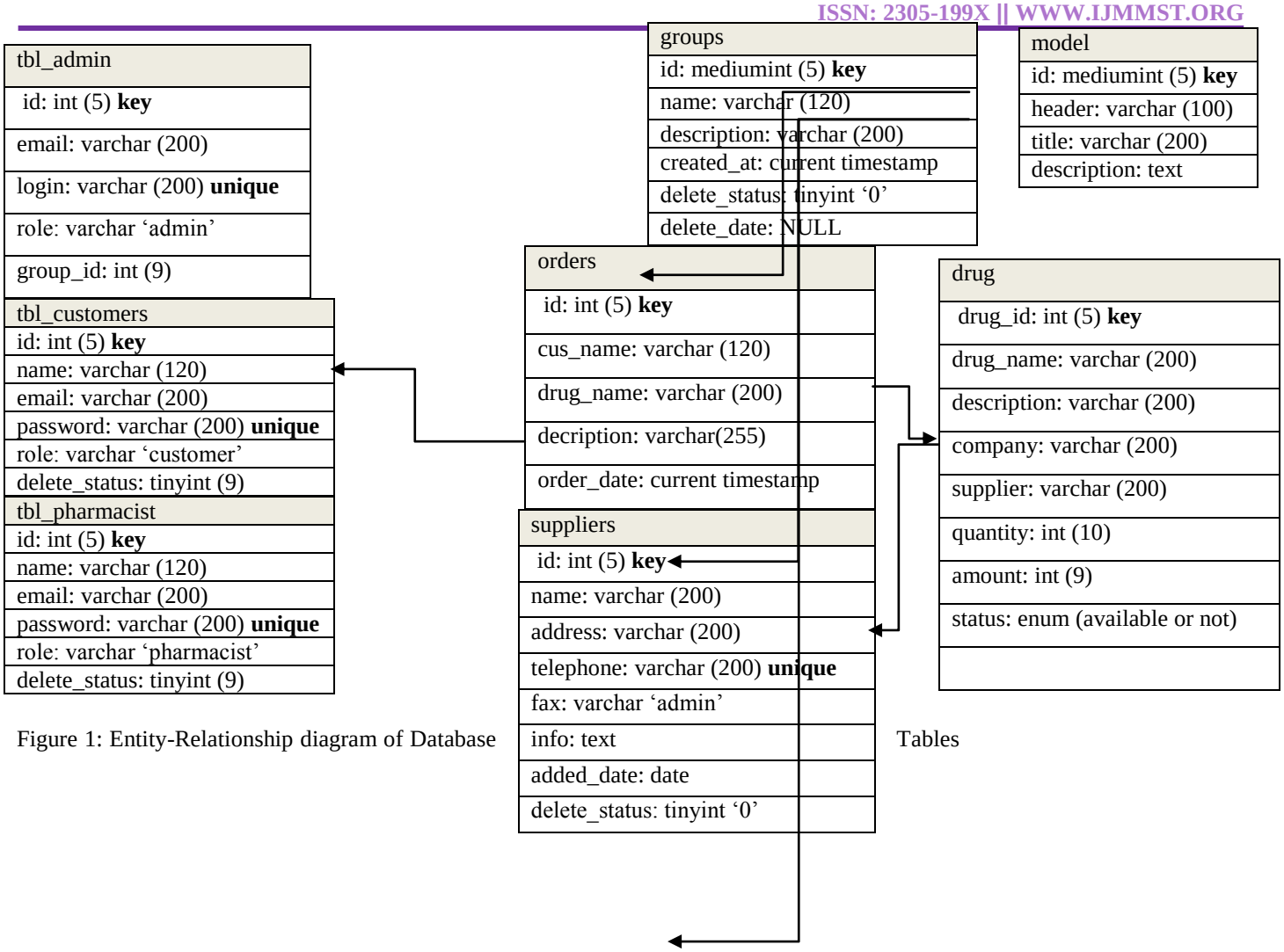

Figure 1: Entity-Relationship diagram of Database Tables

Design Requirements

Design requirements include both the software and hardware requirements used for the designed system.

Software Requirements

i. **Operating System**: Windows (98, 2000, ME, NT, XP, Vista, 7, 8, 10), Linux, Mac OS.
ii. **Java Script-enabled web browsers**: Mozilla Firefox (most suitable), Internet Explorer, Google Chrome and Opera-mini.
iii. **Virtual Server**: XAMPP server cords by simple queries in English Language.

Hardware Requirements

i. A physical memory (RAM) of 512MB and above are required
ii. Intel, Celeron or AMD Pentium 3 processor
iii. Hard disk capacity: 5 GB.

Flow Chart of the Design

The system design flowchart; starting from the Home page to the Admin login page, the Pharmacist login and the customer login page; is presented in figure 2.

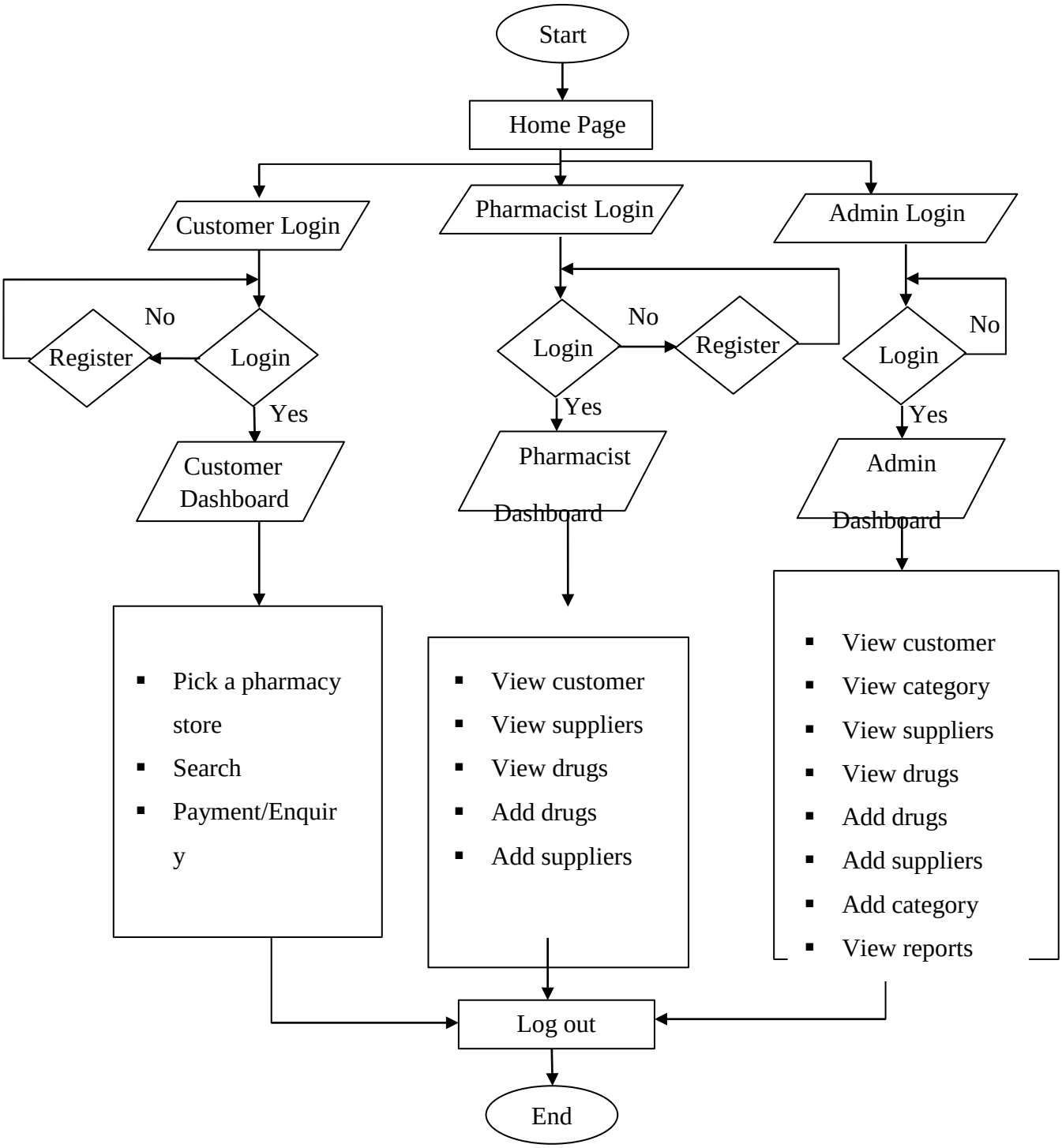

Figure 2: Flow Chart of the Design

RESULTS AND DISCUSSION

System Testing

System Testing was carried out in two stages, namely: -

1. Unit Testing, the system is tested in modules before integration is done. This is important as faults are discovered before the complexity of the system increases through system integration.
2. System Testing, the system is tested for conformity with requirements after all modules have been put together and the system as a whole is tested to authenticate that general system requirements have been met.

In the development of the System, various criterions were used as testing yardsticks of the system.

Graphical User Interface Testing

The Graphical User Interface (GUI) testing involves testing the systems graphic components to ensure that it covers the entire domain i.e. the complete functionality of the system, with respect to the different modules. For example, in the testing of the System, the customer module, pharmacist module and administrator modules were tested to ensure that they all contained links and tables that directly links to their requirements as designed with use cases in the preceding section.

Home page

Home Page is the first interface of the Pharmacy Management System; it provides the basic page where customer, pharmacist and admin can click on to access the Pharmacy system account. The Register, About Admin and other sections are in this page. Figure 3 gives the details of the Home page.

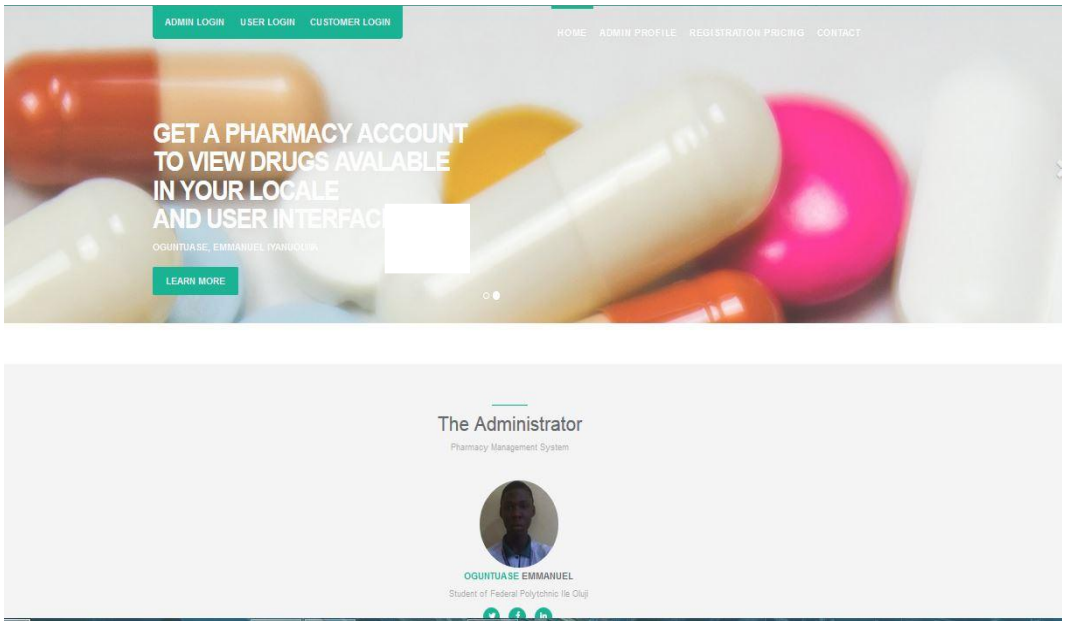

Figure 3: Home Page of the Pharmacy System

Admin login page

Admin login page is an interface in the Pharmacy Management System where only the admin can log in or access the Pharmacy system account. The Register, About Admin and other sections, are on this page. Figure 4 gives the details of the Admin login page.

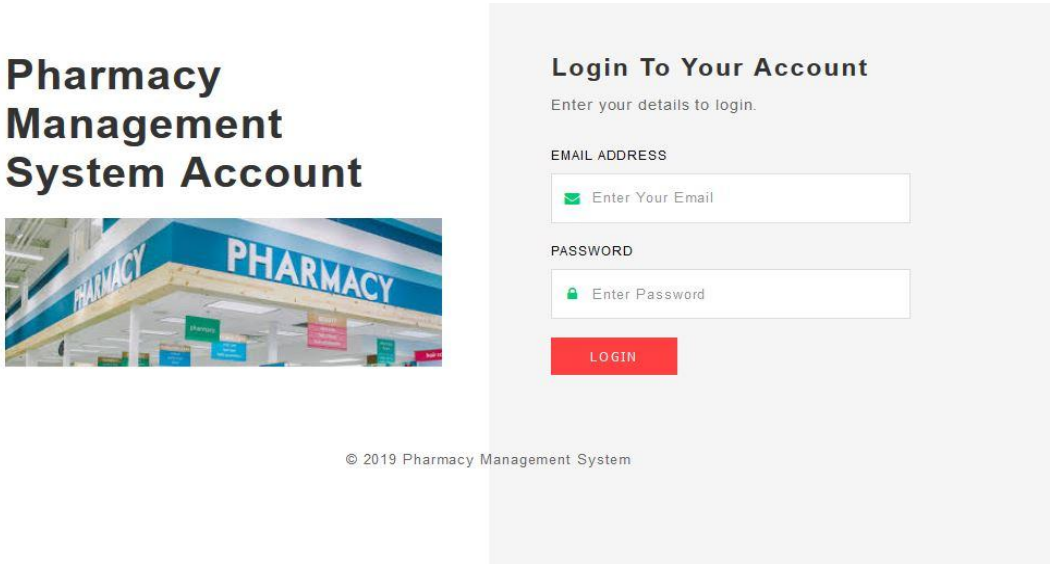

Figure 4: Admin Login page of the Pharmacy System

Admin Dashboard page

Admin Dashboard page is an interface in the Pharmacy Management System where only the admin can access the Pharmacy System Database. The Register, About Admin and other sections, are on this page. Figure 5 gives the details of the Admin Dashboard page.

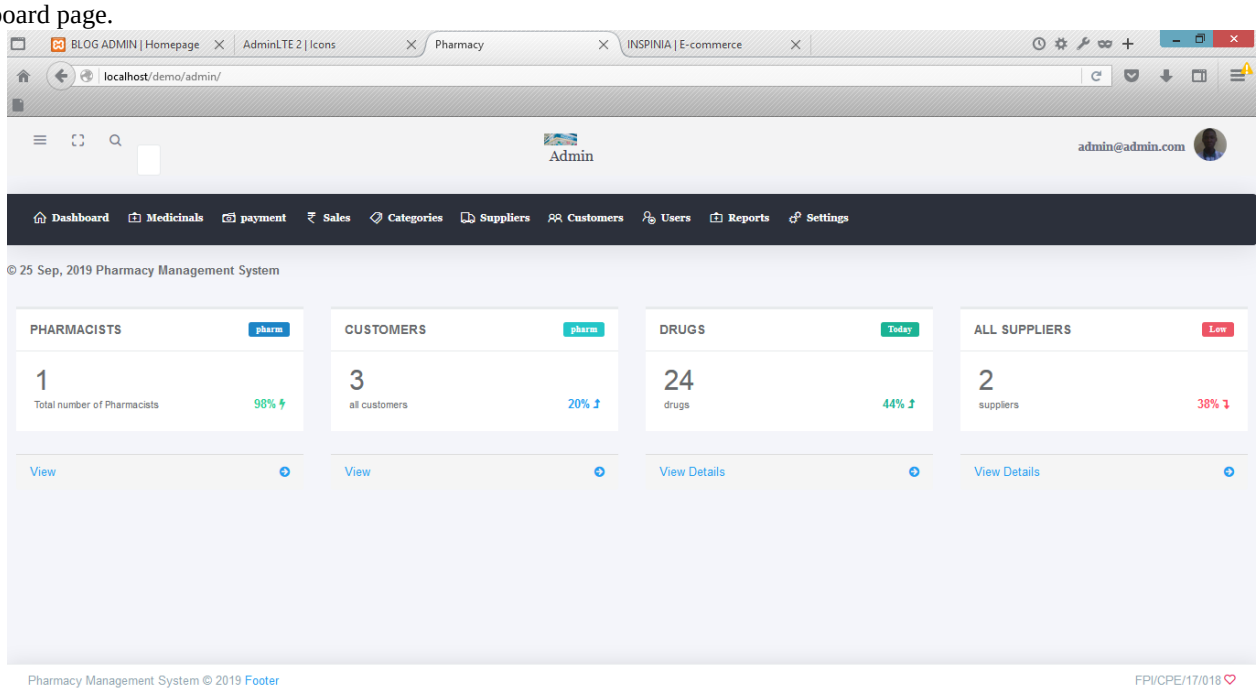

Figure 5: Admin Dashboard page of the Pharmacy System

Customer login page

The customer login page is an interface in the Pharmacy Management System where the customer can log in or access the Pharmacy system account. The Registration can also be accessed through this page. Figure 6 gives the details of the Admin login page.

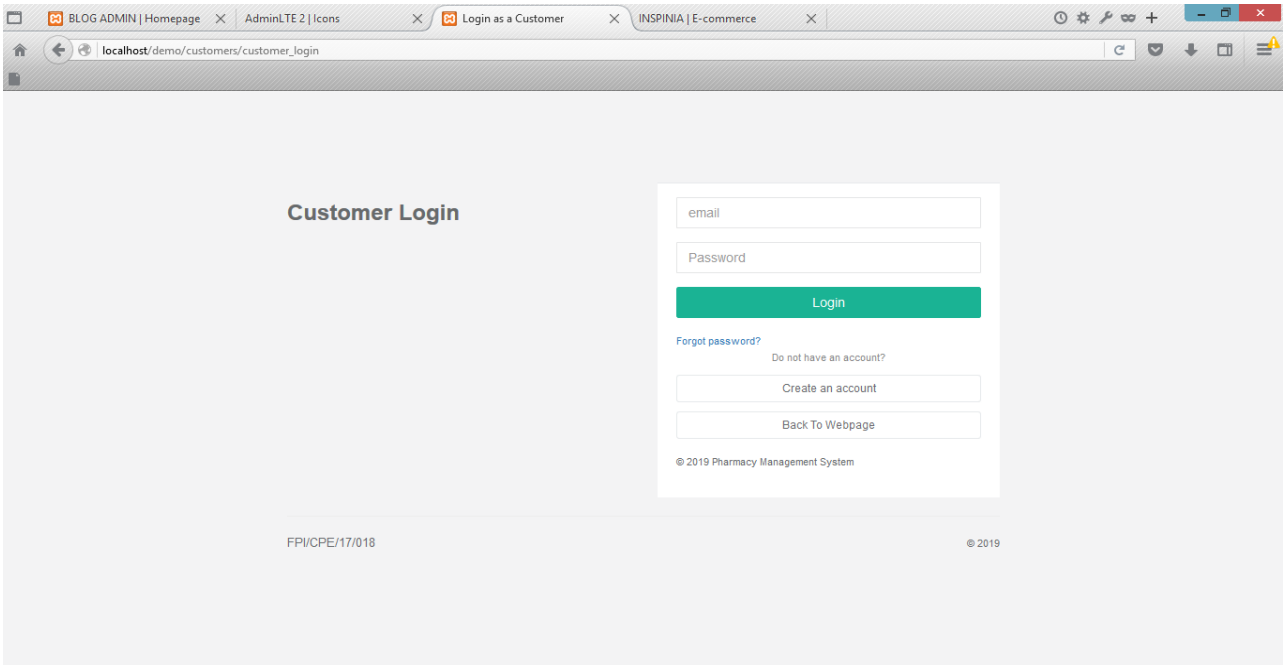

Figure 6: Customer Login page of the Pharmacy System

Customer Dashboard page

Customer Dashboard page is an interface in the Pharmacy Management System where only the admin can access the Pharmacy System Database. Figure 7 gives details of the Customer Dashboard page.

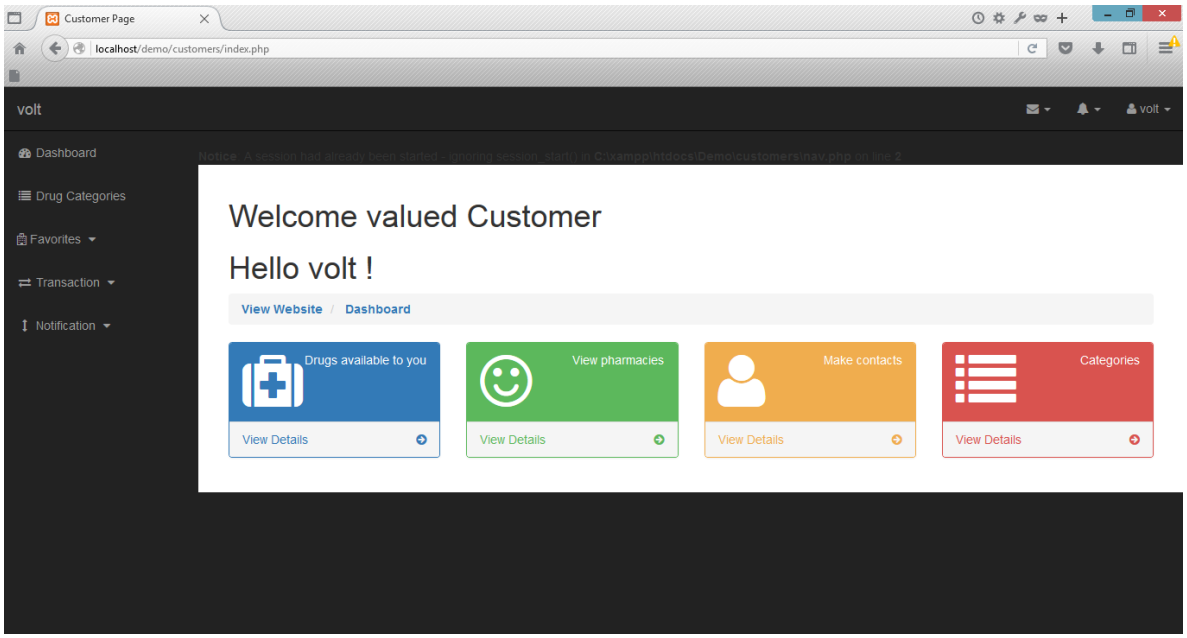

Figure 7: Customer Dashboard page of the Pharmacy System

Pharmacist login page

Pharmacist login page is an interface in Pharmacy Management System where the Pharmacist can login or access the Pharmacy system account. The Registration page (i.e. Pharmacist's) can also be accessed through this page. Figure 8 gives the details of the Pharmacist login page.

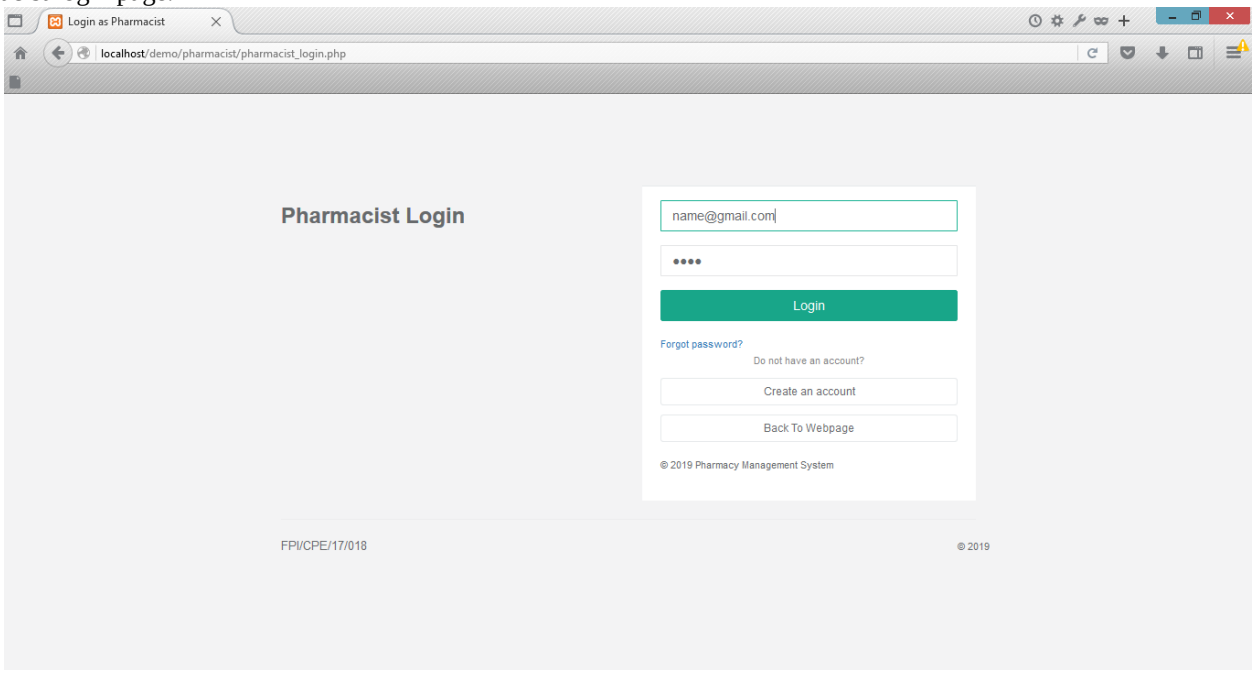

Figure 8: Pharmacist Login page of the Pharmacy System

Pharmacist Dashboard page

The pharmacist's Dashboard page is an interface in the Pharmacy Management System where the Pharmacist can access the Pharmacy System Database. Figure 9 gives the details of the Pharmacist Dashboard page.

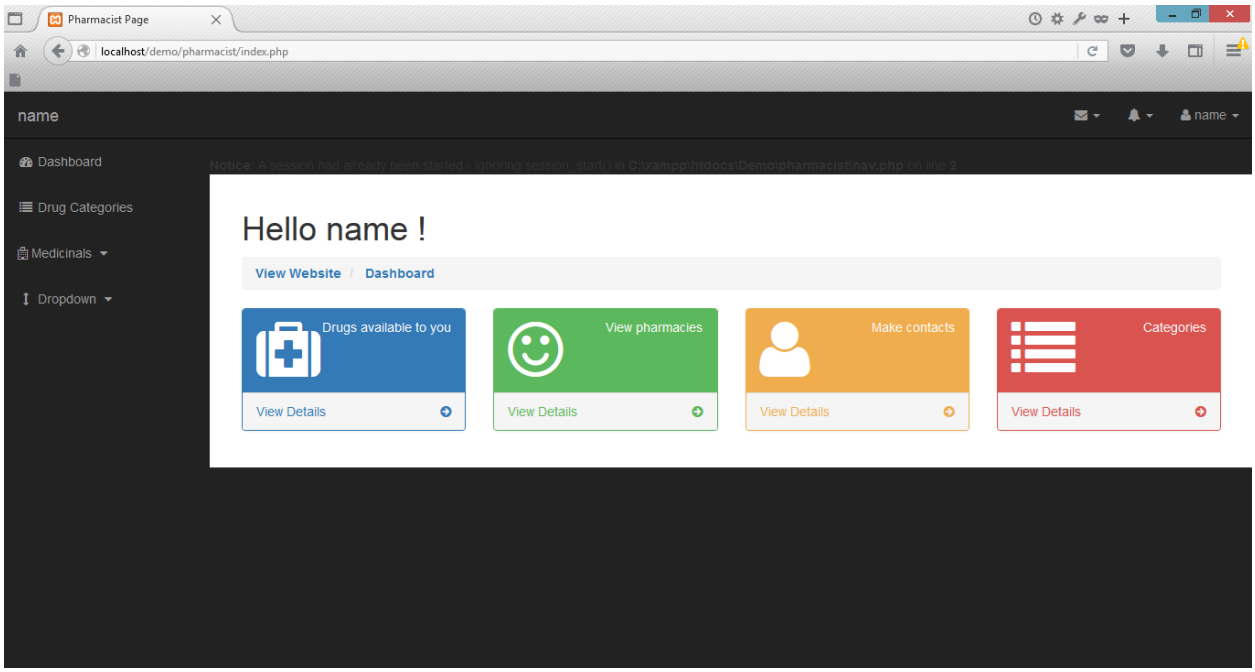

Figure 9: Pharmacist Dashboard page of the Pharmacy System

Database Testing

Database used in the System contains a data dictionary of varying data types. These data types represent the forms of data which the data of the system can take. The data dictionary must be tested to confirm that it has been properly used to implement the system database through the Database Management System (DBMS). The database must also be tested to make sure that the system satisfies the ACID properties (Atomicity, Consistency, Isolation, and Durability) of a DBMS.

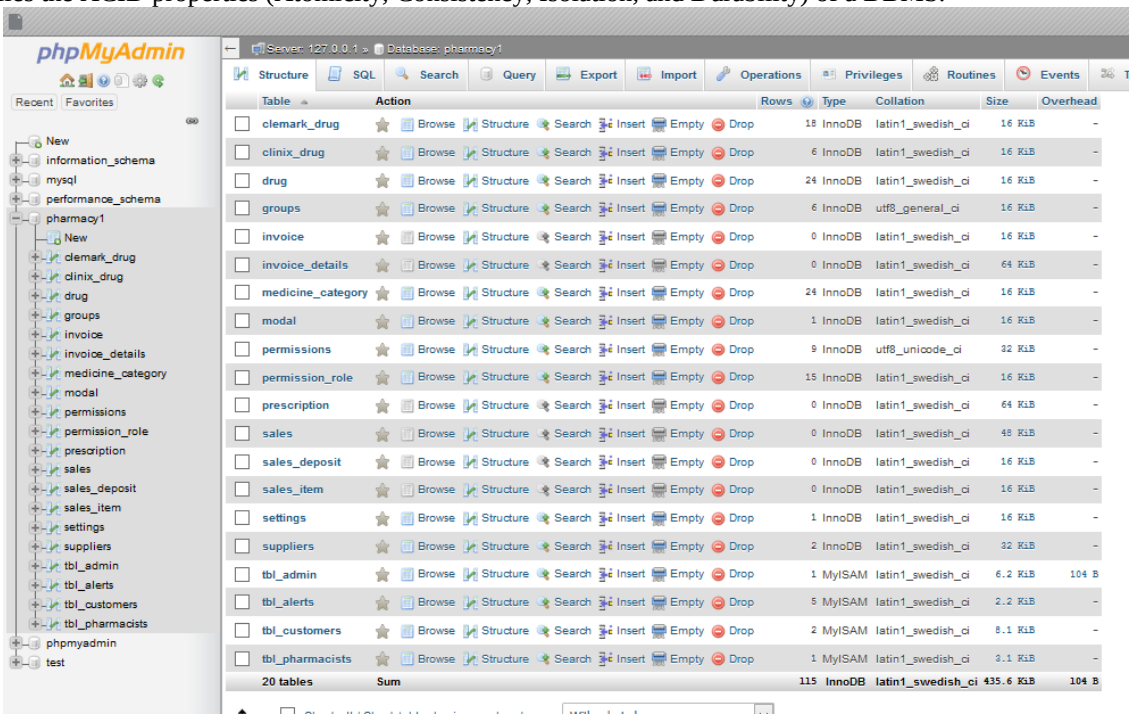

Figure 10: The Database of the system

Figure 10 shows an overview of all the tables contained in the database of the application.

Admin information table

Figure 11 shows all the relevant information about the Administrator(s) of the system. The table contains information such as name, email, password, avatar, and group identification number.

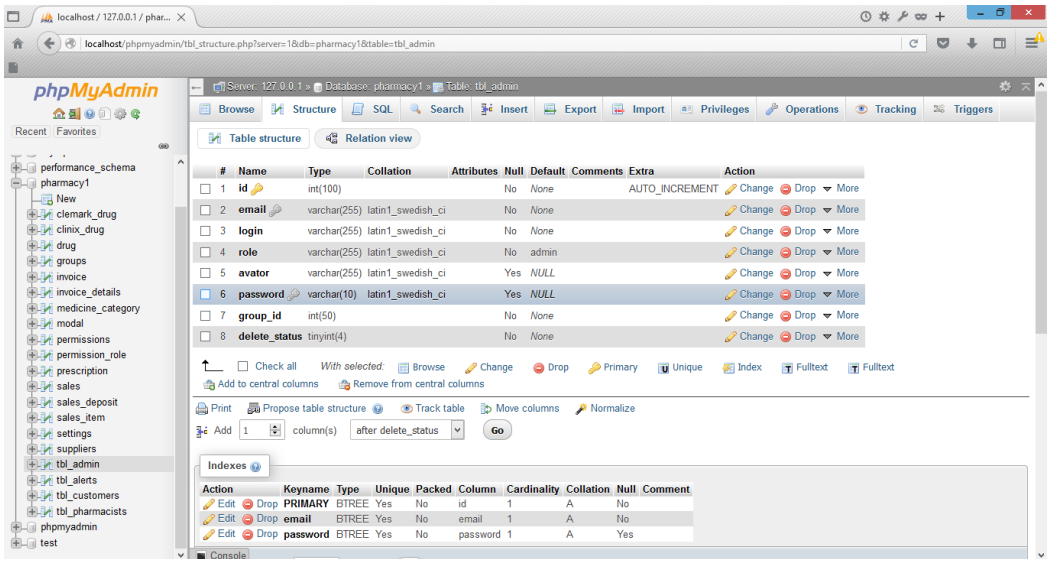

Figure 11: Admin information table

Drug information table

Figure 12 shows the drug table. The table contains information such as Drug name, Drug id, category; description; company; supplier (i.e. Pharmacy stores); amount; quantity; status; and the expiry date; of the drug.

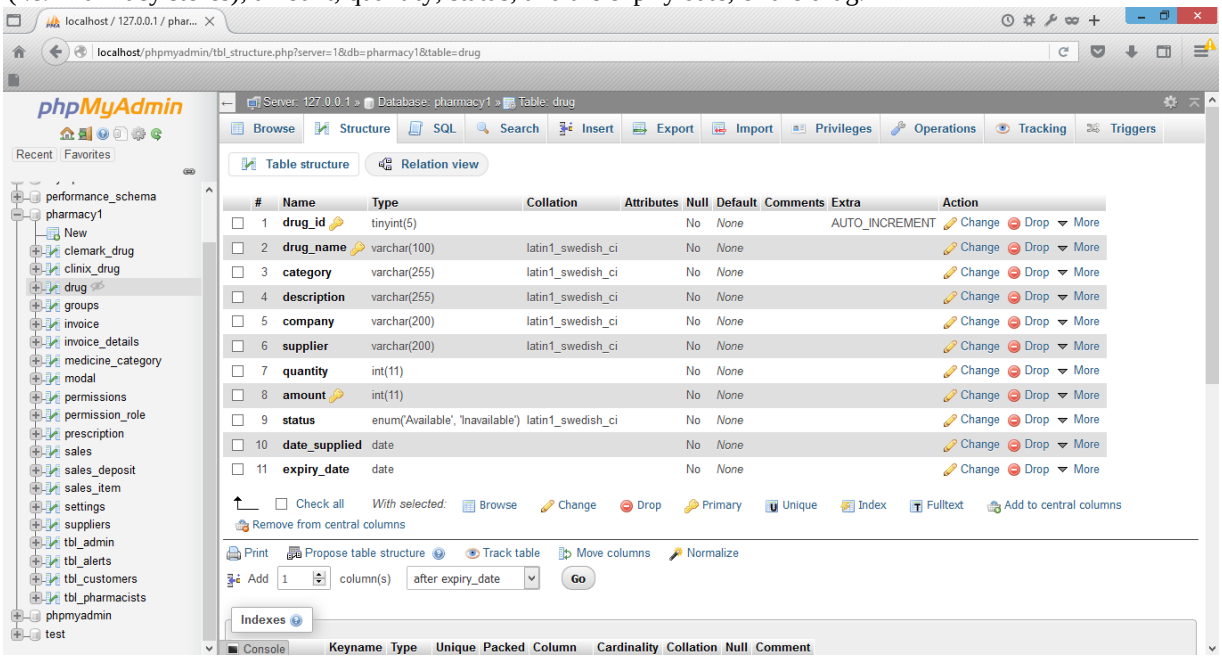

Figure 12: Drug information table

Pharmacist information table

Figure 13 shows all the relevant information about the Pharmacist that have been registered on the system. The Pharmacist login page fetches information from this table for a registered customer to login into the system. The table contains information such as: name, email, password, and group identification number.

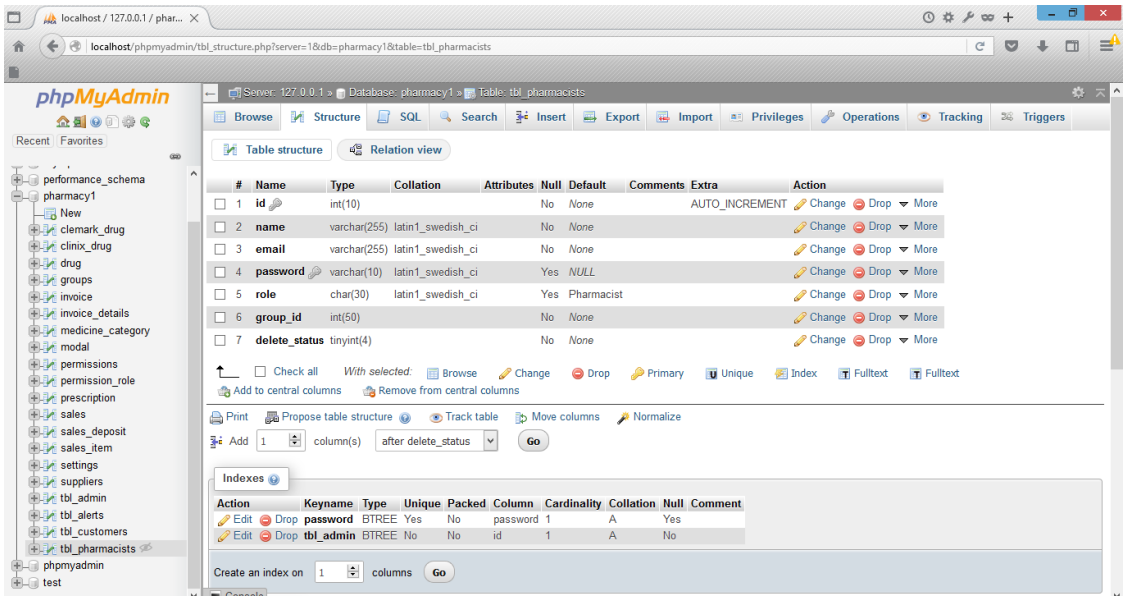

Figure 13: Pharmacist information table

Customer information table

Figure 14 shows all the relevant information about the Customers that have been registered on the system. The Customer login page fetches information from this table for a registered customer to login into the system. The table contains information such as: name, email, password, avatar, and group identification number.

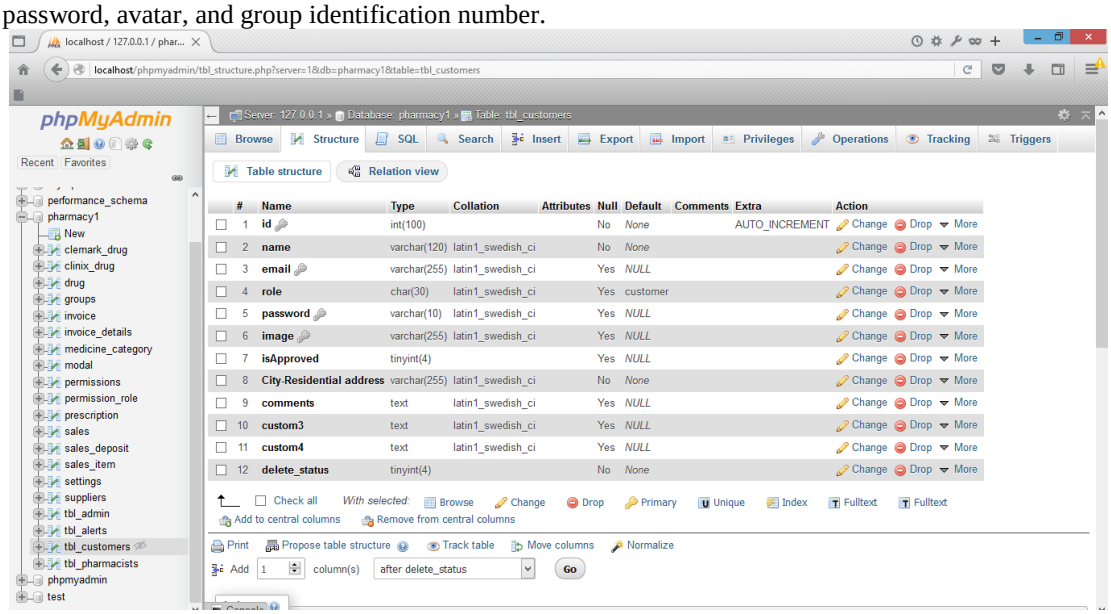

Figure 14: Customer information table

CONCLUSION AND RECOMMENDATION

Conclusion

The management system employs strict measures to protect the drugs from intruders or outsiders. One of such measures is the inability of a prospective user to access to the database without authentication i.e. Registration. To register on the platform, all necessary details such as: name, email, password and relevant licenses (which will be included in other variations) are entered into the database for proper authentication. When the authenticity of these documents have been proven, then the account for the customer will be created for a successful login to the management system. Also, since the drugs purchased through the platform are for pharmaceutical purposes, they are specifically transacted with the pharmaceutical stores.

This project dealt with the Pharmacy Management System Using the waterfall software engineering model. It is eminent that the system provides a safe, secure and verified platform for all parties which helps to bridge the communication gap and provide legitimate drugs. Because drugs are harmful when abused or misused by individuals or organizations. Therefore, if all recommendations are strictly adhered to, there will be strict monitoring and regulation of how drugs are circulated and a decrease in the spread of fake drugs.

Contribution to Knowledge

Being a student and also a researcher; programming is essential in the fields of Computer Science and Computer Engineering, in diverse ways. Developing this project had created a room for improvement on his programming skill, therefore, this project had made the researcher to gain more knowledge on programming, as well as Web development, and Database Management and Administration.

This project had initiated the aspiration for a Certification of an Oracle Database Administrator. It has also allowed the researcher to understand the requirements of becoming a Software Engineer.

Recommendations

In view of the challenges associated with Pharmacy Management System, the researcher makes the following recommendations:

1. All the stakeholders must be computer literate because the system is hosted online.
2. Awareness of the Pharmacy Management System should be made to sensitize people about the significance of the system
3. The various regulatory bodies of the Pharmaceutical Industry should incorporate the use of the system into their regulations.

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