**CLOUD BASED HOTEL RESERVATION SYSTEM**

**BY**

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**A RESEARCH PROJECT SUMMITED TO THE DEPARTMENT OF MATHEMATICAL SCIENCES, FACULTY OF SCIENCE,** **ABUBAKAR TAFAWA BALEWA UNIVERSITY, BAUCHI, IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE AWARD OF THE DEGREE OF BACHELOR OF TECHNOLOGY (B. TECH.) IN COMPUTER SCIENCE**

**FACULTY OF SCIENCE**

**ABUBAKAR TAFAWA BALEWA UNIVERSITY, BAUCHI**

**FEBRUARY, 2020**

# DECLARATION

I hereby declare that this project was written by me and it is my own research work. It has not been presented before in any previous application for any degree. References made on published literatures have been duly acknowledged.

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# CERTIFICATION

The project titled **“CLOUD BASED HOTEL RESERVATION SYSTEM”,** meets the regulations governing the award of Bachelor of Technology Degree in Abubakar Tafawa University, Bauchi and is approved for its contribution to knowledge and literary presentation.

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# DEDICATION

This project is dedicated to God and to my parents.

# ACKNOWLEDGEMENT

My profound gratitude goes to the Almighty God, for His divine presence, preservation and direction in my life and especially in the course of my undergraduate studies.

I deeply appreciate my supervisor in person on Mrs. M. A. Musa for the guidance she offered to me during the course of this research. I actually had peace of mind having you as a supervisor; I will not take that for granted.

I cannot thank my parents and siblings enough for all their care, supports and prayers, most especially towards my academic pursuit and development.

I sincerely appreciate my friends for the diverse moments we had together and most importantly to the memories we made and share.

Lastly, big shout out to all those I encountered in the cause of my undergraduate studies, thank you for the impact.

# ABSTRACT

The rapid spread of the internet is well known, with its size and power making it today’s dominant software development platform. Present technology has gone beyond client-server applications, and new forms of software products are transforming people’s individual work, organizations, and society and Nigeria is not exempted from this technological change. Considering the need for every hotel to sell more rooms and make profit, an online reservation system is now a necessity for hotels as it creates a system that can extend and compete globally, allowing guests to make reservations by selecting preferred room, scheduling dates and length of stay and make payment all on one platform and at the same time. This system thus provides an online reservation system that enables users make room reservations right from where they are and at any time. The system features display of available rooms, alongside room features such the room type, description, price tag and room images portraying the inner view of the rooms to be reserved giving room for customers to reserve room that matches their taste. This system also provides administrative functionalities such as adding of new rooms; edit room, delete room, view all room, current reservations, all reservations, customer check-in and check-out, etc. More so it features cloud technology which offers high uptime, scalability, reliability and adequate security of records. This research collected its data from primary (interview and observation) source and secondary (published materials and the internet) source. The design of the system consist of frontend built with HTML, CSS and JavaScript and the backend using a scripting programming language – Hypertext Preprocessor, PHP. This has achieved its aim which is to automate the process of hotel reservation with minimal downtime.

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# CHAPTER ONE

## INTRODUCTION

### 1.1 Background of the Study

The rapid spread of the internet is well known, with its size and power making it today’s dominant software development platform. Present technology has gone beyond client-server applications, and new forms of software products are transforming people’s individual work, organizations, and society and Nigeria is not exempted from this technological change.

Nigeria is a growing tourist destination, there has been a good rise in the number of hotels and resorts in Nigeria and the tourist sector is broadening, thus the rapid development and commercialization of Information and Communication Technologies (ICTs) for the travel and tourism industry has prompted hotels and other enterprises in this sector to increasingly adopt these technologies. The ICT based products and processes help the hotels to enhance their operating efficiencies, improve the service experience as well as provide a means to access markets on a global basis. The current increase in tourism and rise of foreign investors around the world has made a need for online hotel reservation to come to play as tourists can book a hotel room online even from the airport. The hotel industry has the function of providing hospitality services to customers. These customers can be travelers, foreigners, businessmen, tourists, visitors, etc.

The goal of every hotel is to sell more rooms and make profit, yet without an online reservation system they are forced to remain local while rely on phone calls and walk-ins only to make reservation. An online reservation system is now a necessity for hotels as it creates a system that can extend and compete globally, allowing guests to make reservations by selecting preferred room, scheduling dates and length of stay and make payment all on one platform and at the same time. Online Hotel Reservation System is efficient, yet it is easy and uncomplicated to use. Online hotel reservation provides a hassle-free management of bookings as the reservation system is computerized as it works all the time, affording potential visitors book available rooms anytime and anywhere. It enables one to check available inventory (as it provides an instant ‘picture’ of which rooms are available for reservation) and complete an online reservation with the whole process being less time consuming. It reduces the dependability on Online Travel Agency (OTA) and other travel agents as clients are available to 24x7 reservations and get queries resolved quickly by directly communicating with hotels rather than waiting to get confirmation for their bookings. This would increase the efficiency of staffs as they will not be tied to a phone waiting for guest calls and also reduce cost as it will eliminate email exchanges between guests and reservation personnel. Online reservation reduces workload for staff and optimizes customer service.

Beyond having any great and functional software, it requires the right technology, platform and environment to get the most out of it, especially in terms of adequacy and efficiency. Therefore, having an online reservation system is one thing, but having an effective online reservation system is another, and this is the need for a cloud based hotel reservation system. Cloud is a cluster of Linux servers accessed through the internet. Cloud computing is thus the on-demand availability of [computer](https://en.wikipedia.org/wiki/Computer) [system resources](https://en.wikipedia.org/wiki/System_resource), especially [data storage](https://en.wikipedia.org/wiki/Data_storage) and [computing power](https://en.wikipedia.org/wiki/Computing_power), without direct active management by the user. Cloud technology is a highly scalable and flexible infrastructure that enables developers to build, test and deploy apps. Microsoft defined cloud computing as “the delivery of computing services—including servers, storage, databases, networking, software, analytics, and intelligence—over the Internet (“the cloud”) to offer faster innovation, flexible resources, and economies of scale”.

Cloud is a significant technological development that is being rapidly adopted in this technological age. It is reliable as it provides high uptime and availability, as the system would be virtually using the resources of multiple servers such that if one server goes offline, the system is automatically transferred to another server with zero downtime. Cloud computing also makes data backups and disaster recovery easier as data is mirrored at multiple redundant site on the cloud provider’s network.

Cloud computing eliminates the capital expense of buying hardware and software and setting on-site datacenters i.e. racks of servers thus providing greater return on investment as you pay only for the resources that are used by the system. It also has the ability to scale server resources on demand and hence the system would never go offline unlike deploying the system to a physical server in which when it has technical issues, the system would automatically go down. The cloud also affords vast amount of computing resources such as speed and performance as it accommodates easier load balancing between multiple server environments, thereby putting less strain on a single server’s resources. Also, providers of cloud services regularly upgrade their resources to be very efficient thus reducing network latency.

The cloud providers offer broad set of policies and technologies and control that strengthen the security of the system thus protecting the data and infrastructure from potential threats. This means since the system would have an integrated payment system, the user’s debit card details and other sensitive information of the user is secured from intruders.

### 1.2 Problem Statement

The current system is manual, slow and time consuming and it is very difficult for customers to book through an agent as they would have to await a confirmation for their reservation. As pointed by Polo (2013), “Guests will have to wait for confirmation within 24 hours after their booking”. Some other problems that may occur are:

* Difficulty in handling data accurately, security of data, data lost and viewing by unauthorized persons.
* A customer getting to a hotel and discovers that there are no rooms available for reservation hence they are constrained in trying to get a room to pass the night; as the usual practice is to look for a hotel when you have arrived at a particular location, walk in and find out whether there is a vacant room. In an instance where there is no vacant room, a customer has to move to another hotel (which could be long distance apart) to make the same enquiry once more. As explained by Gabriel “Visitors might have to move around sometimes very late in the night in search of a hotel, exposing themselves to potential threats that might be lurking around only to discover that rooms as also fully booked or perhaps the available room does not suit the taste of the customer. This could also be expensive on the side of the customer.
* A guest checking into a hotel room that is either too expensive or too unbefitting for his/her personality.
* Prolonged delay in retrieving certain information about any particular guest that checked into the hotel whenever such information is demanded as this task is very time consuming and almost impossible practically if time is considered.
* The foul play that sometimes occurs when information about the guest that checked into a hotel is not officially documented by the receptionist etc.
* Also Attendants are quick to serve those who walk in rather than those who may get access to them on phone to book a room hence there is a tendency for one’s reservation not to be entered.
* The return on investment could be reduced as organizations that make room reservations via online travel agents would have to compensate such agents for the services rendered.

Express Hotel which is the purported case study used improved manual system in their room booking (i.e., the use spreadsheet – Excel as the database for their customers). During an interview session with the manager of the hotel, some of the problems that were identified by using spreadsheet packages include:

* Lack of immediate retrievals: Considering the fact that different excel sheets were used to store different transactions such as customer’s information, room details, it is often hard to retrieve and to find the particular information quickly. For example, to find out about a customer’s reservation details, one has to go through various excel sheets. This results in inconvenience and wastage of time.
* File Infection: Since these records are done on excel sheets and are stored on a computer, they could get infected by virus and this could lead to the organization’s loss of important records such as the room reservation and customer’s information.
* Lack of prompt updating: Various changes to information like customer’s details or change of check in date or time are really difficult to make.

### 1.3 Aim and Objectives

The aim of this study is to automate the process of hotel reservation with minimal downtime.

This would be achieved by the following objectives:

* To design and develop a highly scalable online hotel reservation system, with secured features, high uptime, scalability and availability, improved performance and decrease in load times.
* To implement the system using the waterfall model which would curb the manual method of hotel reservation giving room to 24/7 hotel reservation which in turn yields better revenue.

### 1.4 Scope and Limitation of the Study

The study covers the development of a cloud based online hotel reservation system which would facilitate online reservation. The system displays all available rooms coupled with their features to give customers a glance of the rooms to be reserved to meet their taste. These features include the room type, description, price rate, room images (images of the inner room section) alongside the room prices etc. The system keeps customers’ reservation records, add new rooms, view all rooms, manage room reservation such as the control of customer check in and check out date and time, view all and current reservations, view all users, add users; provides secured payment system using an Application Programming Interface (API); automatically generates and send a mail to customer’s provided email containing reservation details, check-in and check-out system for customers using an automatically generated ID: which is a combination of alphabets and the current timestamp of that reservation. However it is limited as the system would not support rescheduling of reservation as payment is made alongside reservation.

# CHAPTER TWO

## LITERATURE REVIEW

Many businesses in this 21st century have not experienced the impact, simplicity and convenience that the internet offers and this has robbed them of several opportunities that exist within their industries and denied them of an avenue to stand out among competitors.

The application of the Internet in the business world has become a major trend in practice and has generated a hot stream of research in the recent literature. The Internet, which is a collection of interconnected computers, provides “free” exchange of information. Several computing devices are connected together and communicate with each other. This in return has made the internet to become a very powerful channel for communication and business marketing and has created room for various business opportunities. E-business as it is generally called allows organizations to have a better presentation of their products and services hence giving them an edge over their competitors. In the same vein, customers can enjoy wider choice of products, services, prices and the ability to make purchase from intending sellers who resides miles away.

The hotel industry is certainly not ignorant of this trend and is fully willing to contribute its share in this effort. The hotel industry in early years did not view e-booking strategically as handed over too much control of their inventory third party agents (online travel agencies). However the industry is in an unenviable position of taking back the reins after early shopping patterns have been established (Delizo and Esguerra, 2013).

Over the years, the need for an online hotel reservation has been on the increase most especially in this technological age. The Hotel Industry like any other business opens up socio-economic opportunities for both owner and customer. It has the function of providing hospitality services to customers (Richard, Akwasi & Emmanuel, 2014). This shows that online hotel reservations systems are increasing in importance and greatly facilitate cross border consumer activities.

The vast growth of the tourism and technological growth has led to the rapid increase in hotel industries. The hotel industry is a fast growing sector which poses great benefit.

Hotels which desire to remain in business and grow its populace and revenue must make their offers and services readily available to potential customers by providing such services on a global scale. Bill Gates once stated that “any business that is not online would soon be out of business”. The customer base is every business’ main concern. Ralph and George (2012) mentioned that customers should be able to reserve the available rooms according to their need in advance so as to make their stay comfortable.

This is very important as it is also supported by Franco and Bulomine (2016) who mentioned that businesses must increase their online presence so as to gain full mastery of their products and services amongst competitors within the same field of operations. This would make their services available anytime, anywhere and thus affording potential online customers to search and make reservations right from where they are. Kendall and Kendall (2019), purported that there are many rewards to mounting an application on the Web: (1) increasing awareness of the availability (2) the possibility of 24-hour access for cases; (3) standardizing the design of the interface; and (4) creating a system that can extend globally rather that remain local, then searching people in remote locations without worry of the time zone in which they are located.

However, the use of manual system of reservation could be frustrating and time wasting. As stated by Williams and Micheal (2018), the management and booking of rooms in hotels is a tedious and complicated task especially if it is done manually. Keeping track of large customers and all their details requires an inordinate space for file cabinets, not to mention the time the hotel administrator would spend going back and forth to file cabinets so as to look up each customer’s information. This is why a good hotel reservation system is needed to make this task as easy as possible.

As supported by Cho, Maw and Tin (2018), managing hotel service is very complex, because it involves job of dealing with customers directly, purchases made by customers and room reservation. The manual hotel management is subdivided into section with each section having specific tasks.

Williams and Micheal (2018) worked on Design and Implementation of Reservation Management System Case Study: Grand Ville Hotels. The system was to understand and make use of the computer to solve some of the problems which are usually encountered during manual operation of the hotel management. The research shows that users preferred online hotel management system to conventional manual hotel processing. He also stated that it is very important to build new and modern flexible, dynamic, effective, compatible and reusable information systems including database to help manipulate different processes and operations that are carried out in hotels.

An effective reservation system has to employ the latest technology to allow hoteliers to gain a competitive advantage over their rivals and remain at the forefront of emerging trends. Online hotel reservations are becoming a very popular method for reserving hotel rooms. Travelers can make room reservations from home by using an online security to protect their privacy and financial information and by using several online travel agents to compare prices and facilities at different hotels (Delizo and Esguerra, 2013).

The need for a stable and secured online resource is of great importance hence the need for implementing a system on the cloud. Many organizations want to move their existing legacy application to the cloud environment because they are facing some problems in adopting new technologies, platforms, and standards (Shrikant, 2014).

Rocha and Vazquez (2014) depicts that “there are several benefits that brings cloud implementation and several competitive opportunities for organizations that use them”. Some of these benefits include cost, competitiveness, availability, scalability etc.

Cloud migration can reduce both capital expense and operating expense costs because resources are only acquired when needed and are only paid for when used. In cloud computing environment resources are managed by third party, so they are responsible for resource maintenance and upgrade (Shrikant, 2014).

[Cloud technology](https://www.siteminder.com/r/technology/hotel-cloud-technology/) can be an especially useful and affordable tool for independent hoteliers who don’t have large budgets.

### 2.2 Hotel Reservation Systems

A hotel reservation system is a computerized system that stores and distributes information of a hotel or resort. It offers assistance to hoteliers to manage all of their online marketing and sales where they can upload their rates and service availabilities to be seen by sales channels. The lists of main modules that are present in a hotel reservation system are: Content, Information stored and reporting.

Content consists of Reservations, Profiles, Rate and Inventory Control, Administration, Global Distribution Interface, Web-based Interface. Information commonly stored consists of room details (room types, room description, room image, room rate etc.), conditions (room status, minimum length of stay, maximum length of stay, etc.), room inventories, generic hotel information (address, phone number, fax number) and Reservation information. The hotel reservation reporting module provides a number of standard reports. System reports may be generated automatically. It includes expected arrivals, reservations, total booking activity and stay activity.

# CHAPTER THREE

## SYSTEM ANALYSIS AND DESIGN

### 3.1 Research Methodology

Research methodology is a systematic programming approach of a well-defined procedure that should be followed in carrying out a thorough research work. It is a system of methods that is used to plan, structure and control the process of developing an information system.

### 3.2 System Analysis

System analysis is the process of collecting and interpreting facts, identifying the problems, and decomposition of a system into its components. System analysis is conducted for the purpose of studying a system or its parts in order to identify its objectives. It is a problem solving technique that improves the system and ensures that all the components of the system work efficiently to accomplish their purpose. Analysis specifies what the system should do therefore it helps to decide a roadmap towards the software development. It includes understanding software product limitations, learning system related problems or changes to be done in existing systems, identifying and addressing the impact of project on organization and personnel etc.

The current system was studied and analyzed to bring to light its weaknesses and to obtain adequate information on how the system should operate. It was thus discovered that the existing manual system made bookings more difficult and time consuming because they were slower and less organized. They were time consuming because potential guests have to make queries in various accommodation facilities to gather information about rates, amenities and services to have as many options to choose from. It also has difficulty in retrieval of customer’s information and modification of customer’s records. The current manual system needs to be made more efficient by developing an online resource for its activities as this would improve organization’s efficiency and produce a high return on investment.

### 3.3 System Design

**System design** is the process of designing the elements of a system such as the architecture, modules and components, the different interfaces of those components and the data that goes through that system. The purpose of system design is to provide sufficient detailed data and information about the system and its system elements to enable the implementation consistent with architectural entities as defined in models and views of the system architecture.

The Waterfall Model was implored as it involves breaking down the requirements/problems, analyzing the system, creating functional code or solution, testing, implementing and software operation and maintenance.

The waterfall model is a breakdown of project activities into linear [sequential](https://en.wikipedia.org/wiki/Sequence) phases, where each phase depends on the deliverables of the previous one and corresponds to a specialization of tasks. It comprises of the following phases:

* Requirements gathering
* System Analysis
* Software Design
* Coding
* Testing
* Implementation

Requirements Gathering

System Analysis

System Design

Coding

Testing

Implementation

Figure : Waterfall Model

#### 3.3.1 Requirement Gathering

Requirements are the high-level descriptions about a particular system services, constraint or to a detailed specification that are generated during the requirements gathering process.

Here, discussion with various stakeholders was made concerning the development of the software to bring out as much requirements as possible. Requirements (user, system and functional) were obtained from the following sources:

1. **Primary Source:** the primary source of information – which comprise of real-time data – employed for the purpose of this research was basically interview and observation.
2. **Interview:** Interview is a common method of data collection in qualitative research to explore the perspectives of respondents on a particular idea, program, or situation.
3. **Observation:** Observation, as the name implies, is a way of collecting data through observing.
4. **Secondary Source:** Here, data was obtained from published materials such as journals, magazines etc. and the internet.

**Types of Requirements**

1. **User Requirements:** This is a detailed description in natural language along with diagrams of the services the system provides and its operational constraints. It is usually development by end users.
2. **System Requirements:** It is a structured document detailing the descriptions of the system’s functions, services and operational constraints.
3. **Functional Requirements:** It describes the services of the system, how the system should react to particular inputs and how the system should behave in definite situations.
4. **Nonfunctional requirements:** It describes the attributes of the system.
5. **Domain Requirements:** These are requirements that arise from the domain of the application and that reflect characteristics of that domain.

#### 3.3.2 System Analysis

It is a process of collecting and interpreting facts, identifying the problems and decomposition of a system into its components. Therefore, at this phase, the current system related problems were studied and examined to bring out the necessary requirements for the software to be developed.

#### 3.3.3 Software Design

At this phase, the whole knowledge of requirements and analysis are brought on deck for the design of the software product. The inputs from users and information gathered in requirement gathering phase are the inputs in this phase. The output of this phase comes in the form of two designs; logical design, and physical design.

#### 3.3.4 Coding

This step involves writing the program code to develop an error-free executable program efficiently. It is also known as the programming phase. This project therefore employs the following technologies:

* **Frontend:** The frontend, also known as the client side of a website is the part that users interact with. It comprises of everything that a user sees when navigating around the Internet, from fonts and colors to dropdown menus and sliders. It is a combination of HTML, CSS, and JavaScript being controlled by your computer’s browser.

The frontend of the system was built using Hypertext Markup Language (HTML) and styled using Cascading Style Sheet (CSS).

HTML is used to build the structure and format of a webpage while CSS allows one to create rules that controls the way the page structures are presented. In essence it is used to style a web page.

JavaScript is the programming language created for the web. It adds interactivity to the web like pop up using alerts to inform the user of some actions that is about to take place. It is today used in programming a robot with an arduino, to running game scripts. Some code editors are built with JavaScript. It is a scripting language and could serve functionalities such as validating form fields, redirecting pages, preventing some actions from occurring by disabling buttons or fields etc.

The frontend of this software runs a framework called bootstrap.

Bootstrap is the most popular HTML, CSS, and JavaScript framework for developing responsive, mobile-first web sites. Bootstrap therefore helps to promote software responsiveness which cuts across all devices.

* **Backend:** The back end, also known as the server side, of a website consists of a server, an application, and a database. Hypertext Pre-processor PHP, a server side programming language is the technology used to develop the server side of the software. It controls all the system functionalities from room reservations to administrative responsibilities such as room management.

PHP is a server side programming language therefore it must run on a server. PHP was run locally on the XAMPP server which is an apparent acronym for (Apache, MariaDB, PHP, Perl).

**Database**: Database is a collection of related data and data is a collection of facts and figures that can be processes stem will handle a large volume of data; it requires a large storage in a form of database. For this purpose, MySQL, a relational database was used to store customers’ record and information locally.

A database management system stores data in such a way that it becomes easier to retrieve, manipulate, and produce information.

**SQL Overview**

SQL is a programming language for Relational Databases. It is designed over relational algebra and tuple relational calculus. SQL comes as a package with all major distributions of RDBMS. SQL comprises both data definition and data manipulation languages. Using the data definition properties of SQL, one can design and modify database schema, whereas data manipulation properties allows SQL to store and retrieve data from database.

* **Cloud Platform:** Cloud is the on-demand availability of computer resources, especially data storage and computing power without direct active management by the user.

Google Cloud Platform’s (GCP) is the technology on which the software features. GCP offers services for compute, storage, networking, big data, machine learning and the internet of things (IoT) as well as cloud management and developer tools. Google cloud storage platform is designed to store large, unstructured data sets. It also offers database storage options including Cloud Data store for NoSQL non-relational storage, Cloud SQL for fully relational storage etc.

It offers some of the following features as stated by Google (n.d.).

* **It scales automatically:** Serve users from zero to planet-scale without even thinking about any infrastructure. Cloud Functions automatically manages and scales underlying infrastructure with the size of workload.
* **No server management:** Deploy your code and let Google run and scale it for you. Cloud Functions abstracts away all the underlying infrastructure, so that you can focus on your code and build applications faster than ever before.
* **Pay only for what you use**: You are only billed for your function’s execution time, metered to the nearest 100 milliseconds. You pay nothing when your function is idle. Cloud Functions automatically spins up and backs down in response to events.
* **End-to-end development and diagnosability:** Go from code to deploy, with integrated monitoring. Get full observability and diagnosability for your application with Stackdriver. Additionally, get support for local and disconnected development/debugging using open sourced functions framework.
* **Paystack:** Paystack is a payment gateway prominently used in Nigeria. It offers enormous benefits amongst which include: Simple, transparent pricing: i.e. zero integration fee, zero maintenance fee; Seamless payments experience: as they provide modern, frictionless and painless payments; Organization and customers protection: by its advanced fraud detection technology using its combination of automated and manual fraud systems to protect from fraudulent transactions and associated chargeback claims; Intelligent Routing: by dynamically routing transactions through different gateways and processors, ensuring optimal payment pathways, and high success rates etc. Thus this would process the hotel reservation payment. Its payment API would be integrated into the system to enhance secured payment.

#### 3.3.5 Testing

Testing is the process of evaluating a system of its components with the intent to find whether it satisfies the specified requirements or not. It tries to examine a system in order to find gaps, errors or missing requirement(s) or any things contrary to the actual requirements.

Software testing is an investigation conducted to provide stakeholders with information about the quality of a software product or service under the test.

There are various testing levels such as:

1. **Unit Testing:** While coding, the programmer performs some tests on that unit of program to know if it is error free. Testing is performed under white-box testing approach. Unit testing helps developers decide that individual units of the program are working as per requirement and are error free.
2. **Integration Testing:** Even if the units of software are working fine individually, there is a need to find out if the units if integrated together would also work without errors.
3. **System Testing:** at this level, the software is compiled as product and then it is tested as a whole.
4. **Acceptance Testing:** When the software is ready to hand over to the customer it has to go through last phase of testing where it is tested for user-interaction and response. This is important because even if the software matches all user requirements and if user does not like the way it appears or works, it may be rejected.
5. **Regression Testing:** Whenever a software product is updated with new code, feature or functionality, it is tested thoroughly to detect if there is any negative impact of the added code. This is known as regression testing.

Testing separately is done just to make sure that there are no hidden bugs or issues left in the software.

#### 3.3.6 Implementation

This means installing the software on user machines. At times, software needs post-installation configurations at user end. Software is tested for portability and adaptability and integration related issues are solved during implementation.

The system was deployed as Software as a Service (SaaS) using the lift and shift migration.

#### 3.3.7 Operation and Maintenance

This phase confirms the software operation in terms of more efficiency and less errors. If required, the users are trained on, or aided with the documentation on how to operate the software and how to keep the software operational. The software is maintained timely by updating the code according to the changes taking place in user end environment or technology.

Customer

Figure : Use Case Diagram: Customer

Administrator

Figure : Use Case Diagram: Administrator

# CHAPTER FOUR

## DESIGN AND IMPLEMENTATION

### 4.1 Design

The system is designed to have a home (index/landing) page: which contains details of available hotel rooms which includes, image, room type, room description, price tag contact page: which contains a contact form that allows user to contact the organization by filling out their names, email, subject and the message to be send to the organization via electronic mail; login page: which permits the system administrator to log into the administrative area and perform administrative duties such as adding of rooms and room features, edit reservations, see all current reservations, users of the system etc.; and an about page: which contains the organization’s details.

### 4.2 Implementation

The system was built using Hypertext Preprocessor PHP, which is enriched with a frontend framework, bootstrap for responsiveness, and JavaScript for interactivity. It also featured MySQL as database and the data manipulation languages were used to store and retrieve data from the database.

#### 4.2.1 Home Page

The home page (landing page) comprises of an introductory view to the system. It provides the following information:

* A Fixed top navigation bar that holds links to the home page, about page and contact page respectively. This is contained within the header tags in the HTML code.
* The body of the home page which consists of a display picture portraying the purpose of the website and also display of all available hotel rooms yet to be reserved. It holds information such as the room type, room descriptions, room image, amount per night and a view more bottom to view more images on the complete room structure – which would give customers a full view of the room they want to reserve even before making reservations.
* Footer: This holds the name and copyright and other site information. It also serves as the end of every webpage.

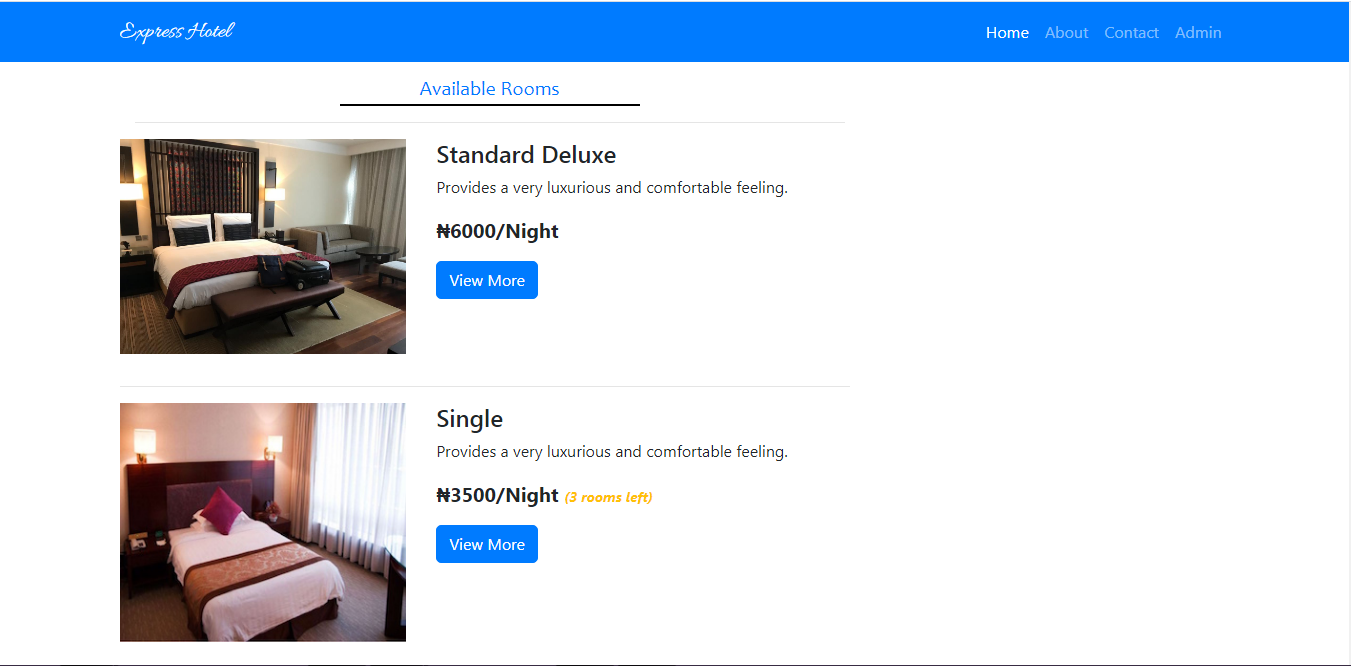


Figure : System Home Page

#### 4.2.2 Login Page

The online reservation system is virtually controlled internally by a system administrator. This administrator has access to all system features. Hence access must be provided for the administrator to get into the system and this is achieved with the use of a login form.

The login page contains the login form which holds form fields for username, password and a sign in button to guarantee access into the system.

Information collected from the login form (username and password) is validated using PHP scripts for authenticity of the provided credentials with the details already stored in the database; and then gives access based on the level privileges and authorization of users.

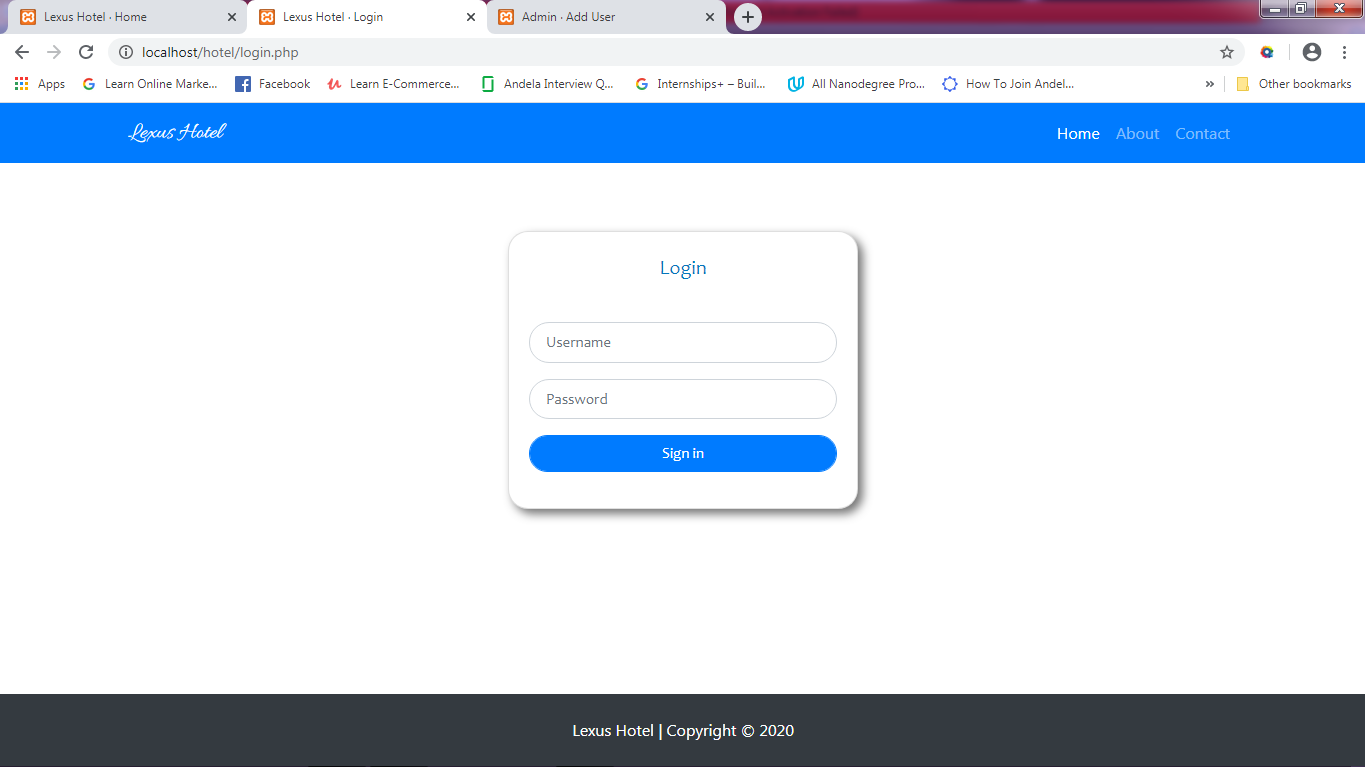


Figure : System Login Page

#### 4.2.3 Contact Page

The contact page enables customers to send messages to the administrator by filling out appropriate fields to convey their messages which could come as problems encountered by the user, appraisal, comments, or perhaps improvement to be done on the system. The form consists of the following fields:

* Full Name: The customer’s full name.
* E-Mail: The customer’s email address. This is needed because the block of code controlling the functionality of the contact page automatically sends an email conveying the provided information to the email provided by the system’s administrator.
* Subject: Title of the message. This form is also necessary since an automatic mail would be sent to the email address provided by system administrator. This would give a proper subject to the message and clarity on what the content of the message entails.
* Message: This contains the body of the message itself. Here the customer expresses his/her opinion in regards to the subject provided.

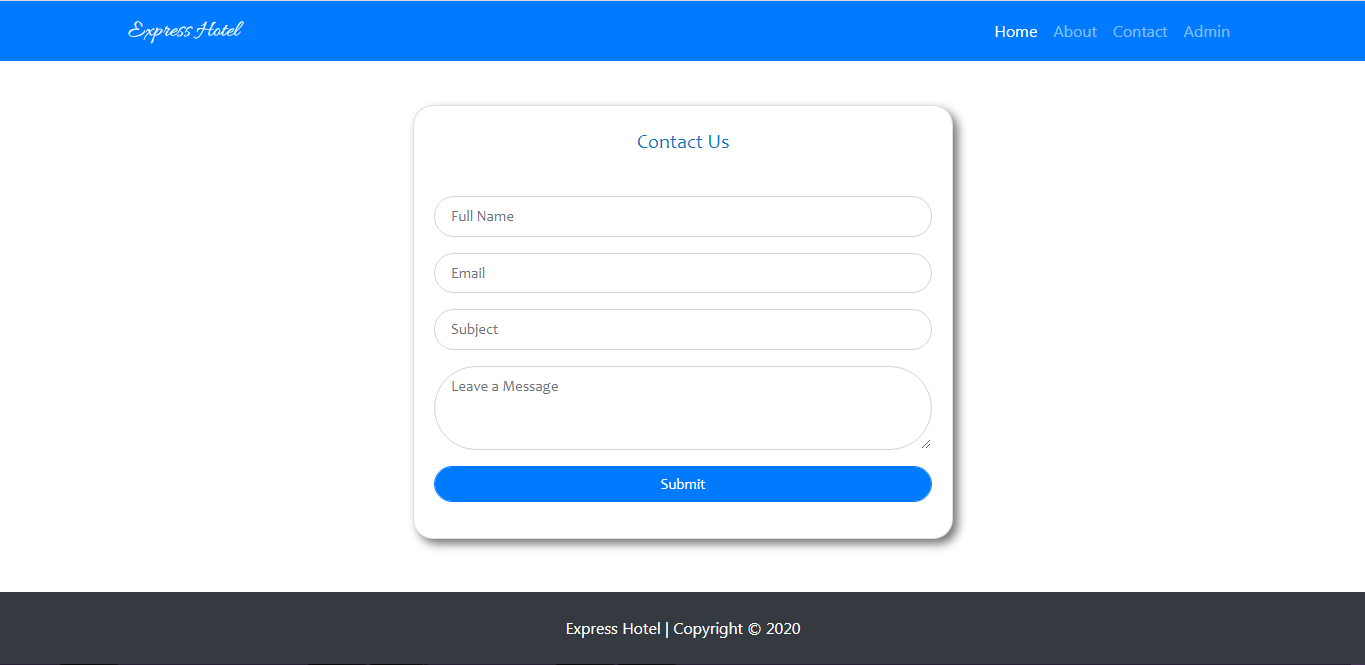


Figure : System Contact Page

#### 4.2.4 Admin

The administrative area gives a full view of the entire system. It consists of the following features:

* **Dashboard:** this dashboard holds information such as the total number of reservations, current reservations, available rooms, number of users etc.
* **Room Section:** this section of the administrative area comprises two parts namely: Rooms and Reservations.

The “Rooms” sub section is made up of three dropdown bottoms which include view all rooms, add new rooms and add room features. The view all rooms gives a representation of all the rooms’ features by the hotel in a tabular manner. It also comprises of edit bottom to edit room information and a delete bottom to delete a room completely. The add new rooms allows the administrator to add a new room specifying the room type, room details, room image, room price, room status etc. the add room features enables the administrator to add additional room features especially images of the inner architecture of the room.

The “Reservations” sub section is made up of two dropdown bottoms which link to the all reservation and the current reservation pages respectively.

The All Reservations Page gives information on all the reservations that has ever been recorded and done on the system. It presents the following customer’s reservation information in a tabular manner: room type, reference ID, booking time, name, email, contact, check-in date, checkout date, nights spent, check-in time and the checkout time. The current reservation gives details on reservations in which the customers have not yet been checked in. It comprises of the following information in a tabular manner: room type, reference ID, booking time/date, email, check-in date, checkout date, nights spent, payment status check-in and checkout buttons.

* **Users Section:** this section contains information on the amount of users (administrators and subscribers) of the system. It comprises of two dropdown buttons which links to the view all users page and the add users page. The view all users page holds user information such as user\_id, first name, last name, email, role and control buttons to either make user an admin, a subscriber, to edit user information or delete user completely.

The add users page provides avenue of added users to the system. It contains forms with the following labels: first name, last name, email, password, and role.

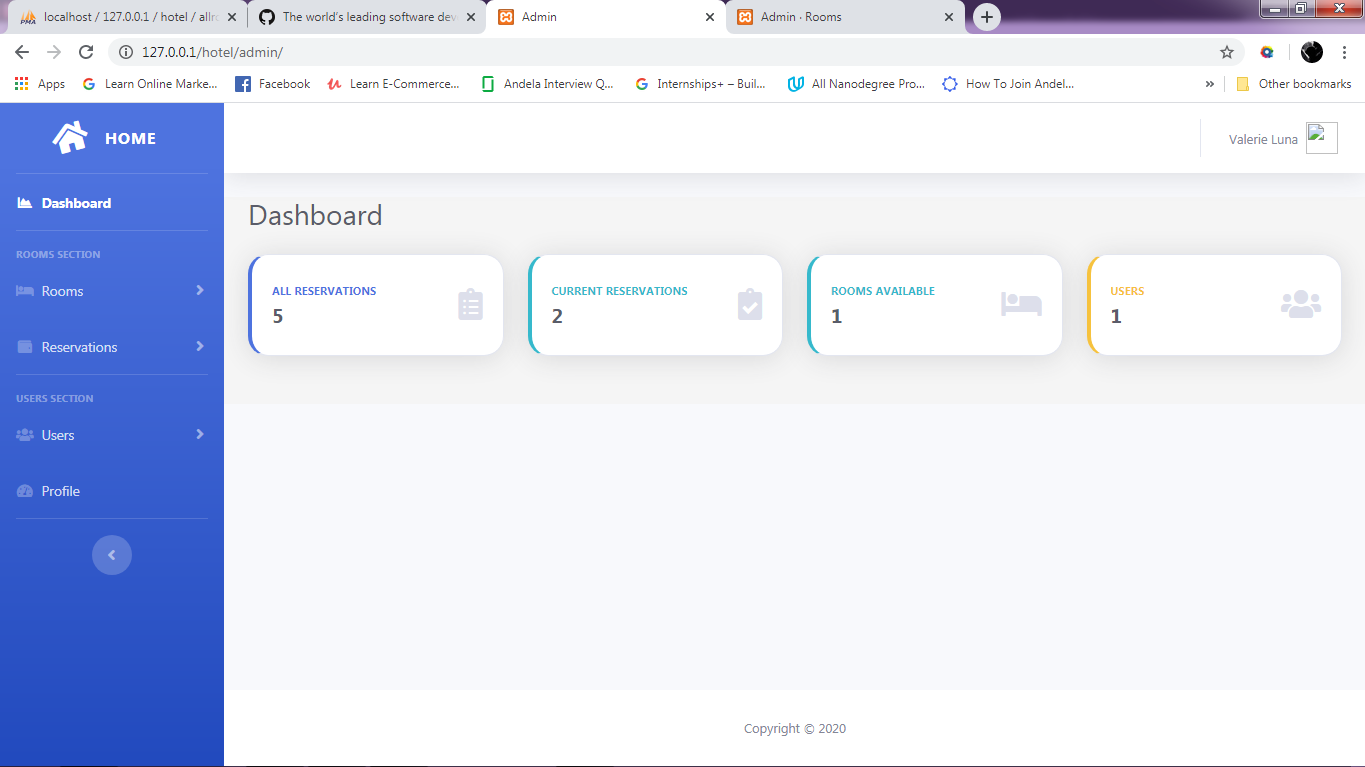


Figure : System Admin (Dashboard) Page

#### 4.2.4 Database Design

The database of the system was created to store relational data and related information concerning the system. The database, its tables (relation) and the respective columns names are each written using the camel case system of writing.

The database comprises of four (4) tables as follows:

* “allRooms” table
* “reservations” table
* “roomFeatures” table and the
* “users” table.

##### 4.2.4.1 All rooms table

This table is designed to store all information pertaining to rooms which include;

* roomId: This is the primary key that uniquely identifies the database entity set.
* roomType: Provides the type of room provided by system such as: Single, Twin or Double Rooms.
* roomDetails: This the luxury/comfort provided by the given room type.
* roomImage: This is the image of the room as displayed on the index page (home page) to provide an internal view of the room intended be booked.
* roomPrice: This is the price tag attached to every room. This price tag is charged on nightly basis.
* roomStatus: This could be either available or unavailable. Room booking and checkout ignites the change in a room status from either available to unavailable or vice versa.
* roomTotal: This gives the total number of a particular type of room.
* roomAvailable: This displays the total number of available rooms of a particular type.

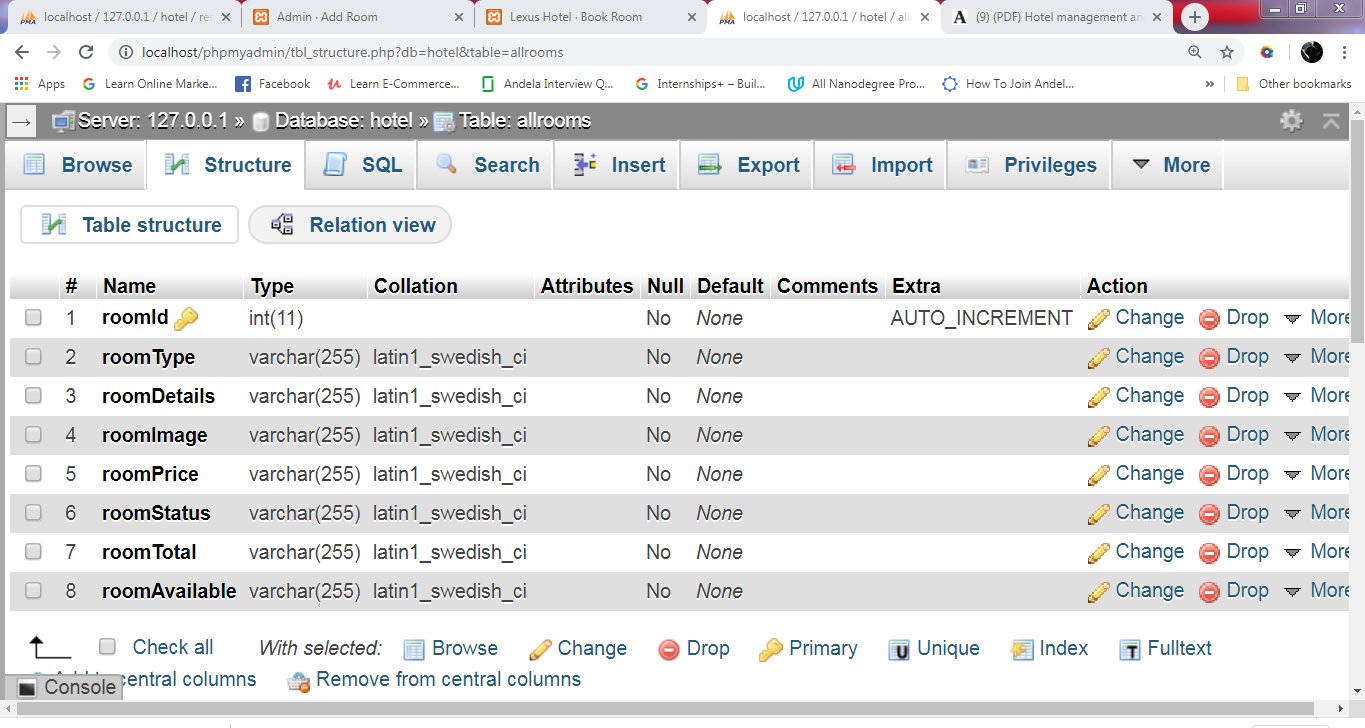


Figure : The allRooms Table Structure

##### 4.2.4.2 Reservations table

This table is designed to store all information pertaining to room reservations.

* id: This is the primary key that uniquely identifies the database entity set. It uses int as the variable type.
* roomType: This indicates the room type to be reserved for the customer. It uses varchar as the variable type.
* referenceId: This column stores the uniquely generated id for every customer. The Id comprises of a sequence of alphabets concatenated with the current reservation timestamp. It uses varchar as the variable type.
* bookingTime: This column store the current time and date of reservation. It uses varchar as the variable type.
* firstName: This is where the first name of the customer is stored using. It uses varchar as the variable type.
* lastName: This is where the first name of the customer is stored. It uses varchar as the variable type.
* email: This hold the electronic mail address of the customer. It uses varchar as the variable type.
* phoneNumber: Contains the customer’s contact detail. It uses varchar as the variable type.
* checkInDate: This stores record of the date a customer would check into the hotel room. It uses the date variable type.
* checkOutDate: This stores record of the date a customer would check out of the hotel room. It uses the date variable type.
* nights: This column stores the calculated number of nights to be spent by the customer using the information provided in the check-in-date and check-out-date fields. It uses varchar as the variable type.
* checkInTime: This keeps record of the time the customer checked into the hotel room. It uses timestamp as the variable type.
* checkOutTime: This keeps record of the time the customer checked out of the hotel room. It uses timestamp as the variable type.
* country: This fall under the customers contact details to indicate the customer’s country of origin.
* gender: This is used to store the gender information selected from the drop down menu provided on the home page.
* residentialAddress: This stores the residential address of the customer. It is a necessary contact information
* amount: This stores the calculated amount to be paid by the customer that is, the room price multiplied by the number of nights to be spent.
* paymentStatus: This holds the status of payment of every transaction. By default it is “Not Paid”, however, upon payment confirmation, it changes to “paid”.
* hasCheckedout: by default this field is stores “No”. Once a customer is checked out of the hotel room, the field is updated to a “Yes”.

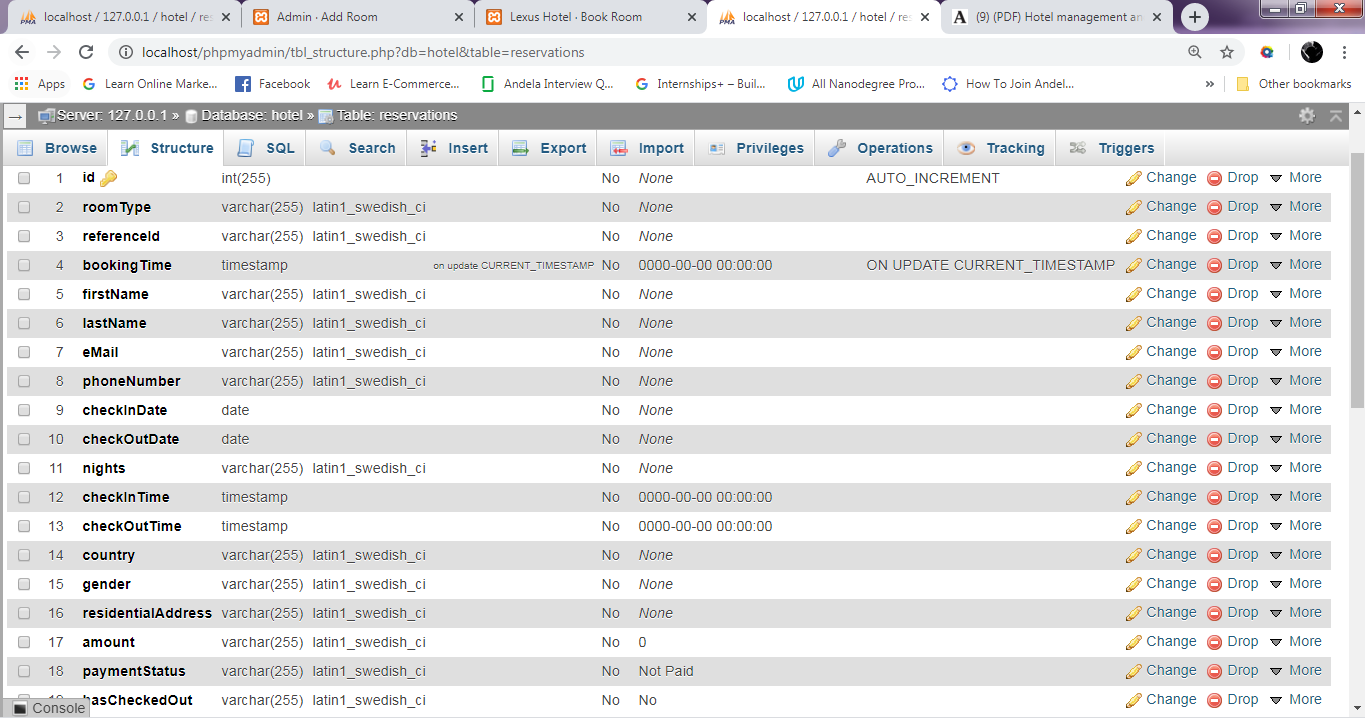


Figure : The reservations Table Structure

##### 4.2.4.3 Room features table

This table stores images of all the room features. The aim of this is to give customers an overview of the internal luxury of the room(s) they intend to reserve – owing to the fact that customers may have different taste – and this also serves as a proof of quality products and services so the customers can get what they paid for. This feature ranges from the room type, wardrobe, toilet and bathroom facilities plus kit etc.

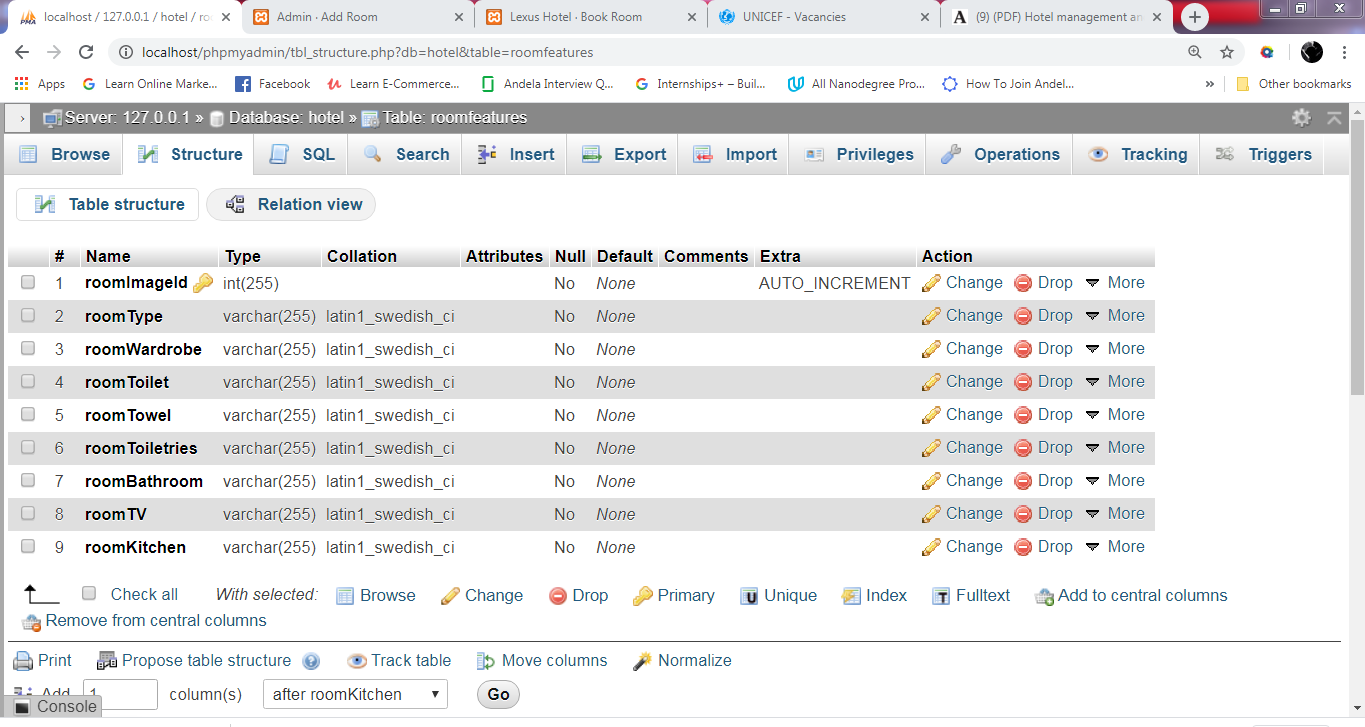


Figure : The roomFeatures Table Structure

##### 4.2.4.4 Users table

This table stores the users of the database system. It comprises of the following columns:

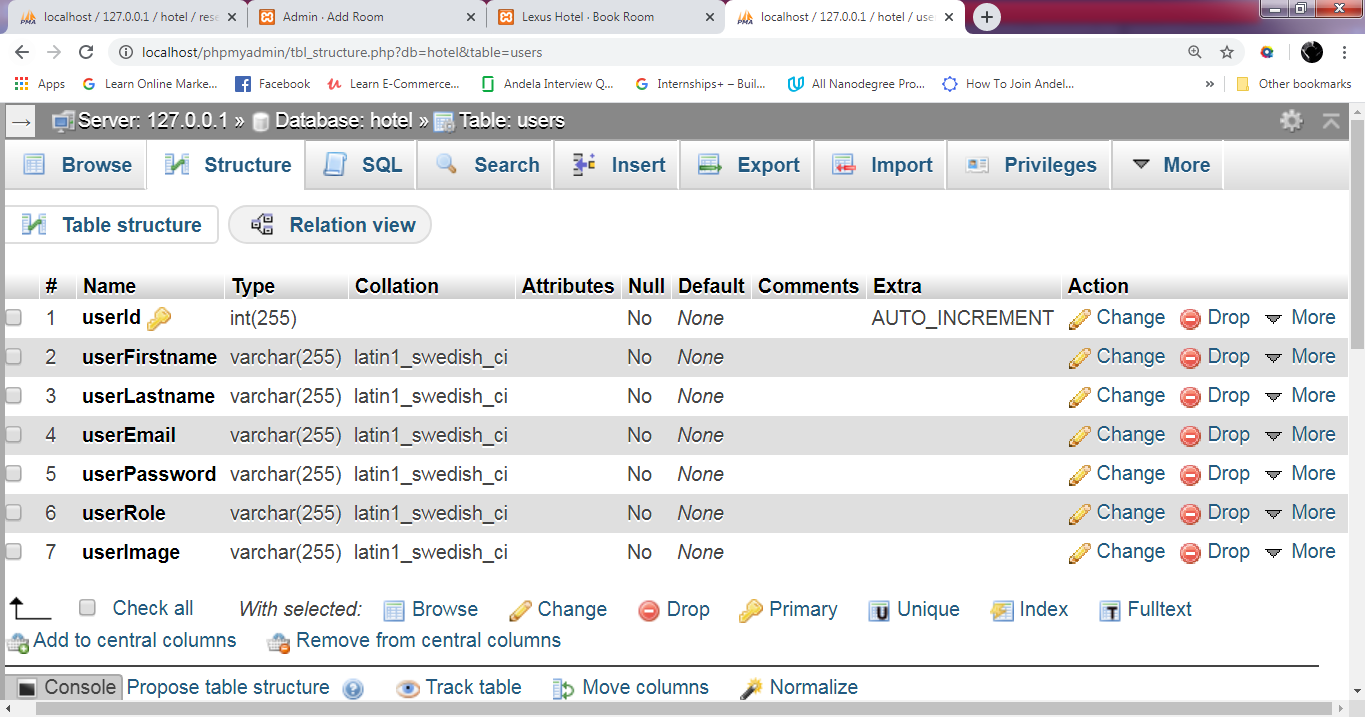
* userId: This is the primary key that uniquely identifies the database entity set.
* userFirstname: This field stores the user’s first name.
* userLastname: This field stores the user’s last name.
* userEmail: This field stores the user’s email which serves as one of its login credentials.
* userPassword: This stores the hashed version of the user’s password. The password\_hash function is used to create a password hash so that even if a third party gains access to the database, the passwords of users are stored as hashes instead of plain text. The password\_hash function uses an algorithm, PASSWORD\_BCRYPT to encrypt the software using the blowfish technology. It also takes a cost as a parameter indicating how many times the hash should be performed.
* userRole: Stores the roles of users. Users may include an administration and a subscriber.
* userImage: This stores the image of the user and allows a query to be run to retrieve the image for display on the user’s profile.

Figure : The users Table Structure

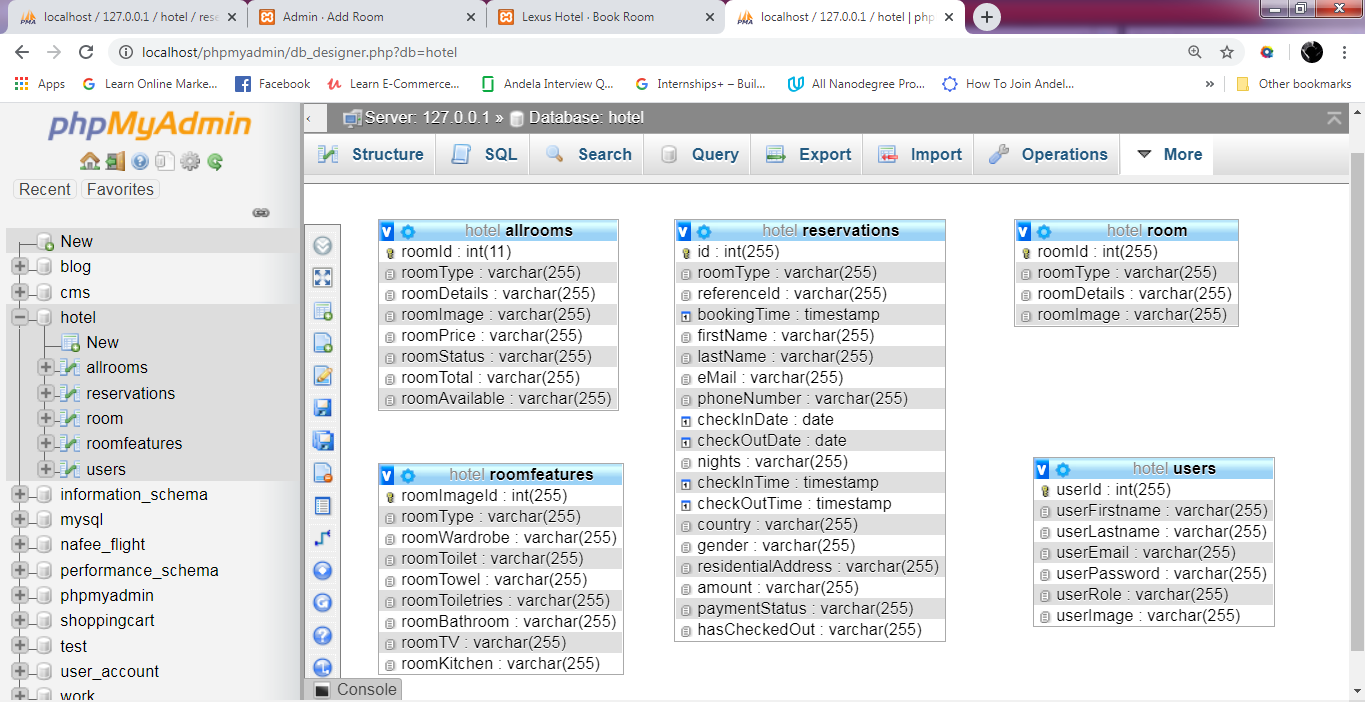


Figure : Database Entity Relationship Model Schema

# CHAPTER FIVE

## SUMMARY, CONCLUSION AND RECOMMENDATIONS

### 5.1 Summary

Online hotel reservation system is a platform that grants customers access to online hotel reservations from anywhere in the world at any given time. However, to grant responsive access to customers, the software used cloud technology which provides a highly scalable online hotel reservation system, with secured features, high uptime, scalability and availability, improved performance and decrease in load times.

The system is developed using frontend technologies (HTML, CSS, and JavaScript) and runs a Bootstrap framework for software responsiveness. The backend technology used is Hypertext Preprocessor, PHP which uses its scripts to control the whole software functionalities ranging for room reservations, payment integration, administrative and server side functionalities.

This system also features a payment integration which allows customers to make on-the-spot payment so as to validate and complete their room reservations. A randomly generated ID comprising of sequence of characters and the current timestamp is created to uniquely identify each customer’s transactions.

The application is featured on a relational database, MySQL which is used to store all reservations records.

The system consists of a login page for validation of user’s authenticity before granting access into the system. The administrator manages the entire workforce of the system by carrying our administrative activities specified in the system.

### 5.2 Conclusion

It is to this end that any business, as in our case, a hotel industry, that must scale in this 21st century and beyond must be available on the online resource. This grants the organization a competitive edge as it earns them a global access for 24 hours a day, 7 days a week, online services instead of been limited to the local environment where they could be found. It also improves client services through greater flexibility as clients can gain access to hotel rooms, make reservation with secured their payments from any part of the world as it also promotes increase in professionalism as it provides opportunity for the hotels to be managed from any part of the world.

Furthermore, being on the cloud affords various benefits for a hotel industry amongst which includes; security, as it is the responsibility of cloud service providers to carefully monitor security and update their facilities to foster this feature; scalability, this warrants the software to be scale up i.e. adding of extra computing resource such as automatically adding an extra CPU and scaling out e.g. adding more servers when the software may require it and in turn improves the speed and efficiency of the software etc.

In conclusion, this research work achieves its aim which is to design and develop a highly scalable online hotel reservation system, with secured features, high uptime, scalability and availability, improved performance and decrease in load times.

### 5.3 Recommendations

This research work has achieved its aim and also serves as a reference point to the development of an online reservation system. Having understood clearly the process of the design and implementation on a cloud based hotel reservation system, the following is however strongly recommended:

This research recommends that for any business to scale in this 21st century; it must give adequate priority to online presence and 24/7 availability so as to gain full mastery of their products and services amongst competitors. This would in turn increase its level of productivity increase in return on investment.

The advent of cloud technology and the advantages it offers cannot be overemphasized, hence in this ever growing digital age, it in prominent for organizations to leverage the benefits that the cloud proffers.

In order to complete and validate the customers’ room reservations, an online hotel reservation system should be integrated with a payment gateway to enable customers to perform on-the-spot reservations on a single platform.

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