

A DISTRIBUTED AIRLINE RESERVATION SYSTEM FOR NIGERIAN AIRLINE COMPANIES

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Abstract: This study focused on the development of a distributed airline reservation system that is capable of resolving some problems of the existing system that include the difficulty to easily reschedule previously booked flights online or transfer ownership of tickets from one user to the other without consulting office agents, inability to support users who want to book and travel instantly rather than the prior 72 hours booking before the departure time, and also the inability of users to control their times of flight instead of choosing prescribed times provided by the airline agents. Existing reservation systems, airline reservation systems and reservation techniques were explicitly examined as a guide to the development of the new system. The system was designed using the structured system analysis and design methodology (SSADM) and developed using PHP, JavaScript and HTML as the programming languages, while the database was designed using MySQL. Case tools and data flow diagram were used during the development process to simulate the process of airline reservation and ticket booking. The system was tested using sample data collected from Aero Contractors and the outcome was a more user-friendly airline reservation system capable of resolving the problems identified in the existing system.

Keywords: Airline, Reservation, Distributed, Booking

I. INTRODUCTION

1.1 Airline Reservation

The desire for improvement in fields like science and technology is a constant subject which has continually triggered lots of advancements [1]. This desire can be seen in all disciplines, and the airline industry which is a product of technology is not an exception. The airline reservation systems were first introduced in the late 1950s as simple standalone systems to control flight inventory, maintain flight schedules, seat assignments and aircraft loading. Today, modern airline reservation systems are comprehensive suites of products to provide systems that assist with a variety of airline management tasks and meet the customer's needs from the time of initial reservation through the completion of the flight [2].

Over the years, the World Wide Web and the Internet have become tremendously popular with an increase in the number of industries that have incorporated a web based distributed approach in interacting with their customers. As with these industries that have innovated, most airlines have also made provision for a distributed reservation

system of their flights. The implementation of this online system has created a major resource via the internet for people who want to make reservations online without the hassle of meeting travel agents. Also, this has ensured that reservations are not only generated by the staff of the airline, but also by any travel agent using a global distribution system or other airlines that have a multilateral Interline traffic agreement with the airline [3].

A computer reservation system is a computerized system used to store and retrieve information, and conduct transactions related to travelling. Computer reservation systems are classified as Passenger Service Systems (PSS) which handle a series of critical functions for the airline. For an airline, the reservation system is a mission critical system that should use the latest state of the art technology to provide for all flight reservations on a robust platform, which is flexible and can be adapted to any style of the airline [4].

Airline Reservation Systems (ARS) used to be standalone systems. Each airline had its own system, disconnected from other airlines or ticket agents, and usable only by a designated number of

airline employees. Travel agents in the 1970s pushed for access to the airlines' systems. Today, air travel information is linked, stored, and retrieved by a network of Computer Reservations Systems (CRS), accessible by multiple airlines, thereby making the systems accessible to consumers directly. These reservation portals and gateways on the web allow consumers to purchase tickets directly, select seats, and even book hotels and rental cars [5].

ARS eventually evolved into the computer reservations system (CRS). Computer Reservations Systems (CRSs) are used for hosting airline seat inventory and seat reservation transactions [6]. This system is used for the reservations of a particular airline and interfaces with a global distribution system (GDS) which supports travel agencies and other distribution channels in making reservations for most major airlines in a single system. An airline direct distribution works with its reservation system as well as pushing out information to the GDS [7].

Aero Contractors Company of Nigeria Limited, also known as Aero Contractors is a state-controlled Nigerian aviation company based at Murtala Muhammed International Airport in Ikeja, Lagos State, Nigeria. It was formed in 1959 and officially registered in Nigeria in 1960. At that time, it was a wholly owned by Schreiner Airways B. V. of the Netherlands; it became a company with initially 40% Nigerian holding in 1973 and subsequently 60% in 1976, anticipating the requirements of the Nigerian Enterprises Promotion Decree of 1977, also known as the indigenization decree [8].

1.2 Reservation Information Systems

The airline reservations system was one of the earliest changes to improve efficiency in the airline industry. Airline reservation system eventually evolved into the computer reservations system (CRS). Airline reservations system is a computerized system used to store and retrieve information and conduct transactions related to air travel. The systems was originally designed and operated by airlines, but were later extended for the use of travel agencies [8].

Major airline reservation system operations that book and sell tickets for multiple airlines are known as Global Distribution Systems (GDS). Airlines have disposed most of their direct holdings to dedicated GDS companies, who make their systems accessible to consumers through Internet gateways. Modern Global Distribution Systems typically allow users to book hotel rooms and rental cars as well as airline tickets [3].

Global Distribution System (GDS) is a worldwide computerized reservation network used as a single point of access for reserving airline seats, hotel rooms, rental cars, and other travel

related items by travel agents, online reservation sites, and large corporations. The premier global distribution systems were Amadeus, Galileo, Sabre, and World span. They are owned and operated as joint ventures by major airlines, car rental companies, and hotel groups [9].

According to the author in [10], the components of reservation information system include hardware, software, data, people, procedures and database.

1.3 Advantages of Reservation Information System

Convenience: One advantage of booking a hotel, flight or car rental online is the convenience. Being able to make all your travel plans on the Internet means you can do it any time of the day or night at home, or while you are on your lunch break at the office. Customers on the go can even make reservations on their smartphones or tablets. There is no need for lengthy phone calls or visits to a travel agency, with just a few minutes and a click of the mouse, you will have all your plans finalized [11].

Changes and Cancellations: It is simple for travelers to change or cancel online reservations. Instead of calling the hotel or airline and waiting for a customer service representative to help them through the process, booking online means you can do it wherever you have Internet access.

Customer Reviews: Making a reservation over the phone or at a travel agency does not allow you to check out what past customers have thought of hotel chains or certain airlines. Another benefit of making online reservations is being able to see these customer reviews [12].

II. PROBLEM DEFINITION

The current system of reservations is though an online system but still has some inefficiency. These inefficiencies include the difficulty to easily reschedule previously booked flights online, difficulty in transfer ownership of tickets from one user to the other without consulting office agents, inability to support users who want to book and travel instantly without going through the processes of manual pre-booking 72 hours before the departure time, absence of a Frequently Asked Question(FAQ) section to handle users' queries users about flights and also the inability of users to control their times of flight instead of choosing prescribed time provided by the airline agent.

Also, most of the current reservation systems are still manual, and are as a result slow, time consuming and can be difficult for each person to book through office agents. This means that users have to inquire about the tickets through phones and this makes it difficult to correctly take down or remember all the details that provided through

phone calls. It can be very difficult to calculate how many people registered and how many seats are on a particular online booking; or to keep customer records, provide an online menu on flight schedules, flight destinations and their prices, show alternative links to other partner airlines and have a page dedicated to customer queries and replies. This necessitates the design of a distributed airline reservation system that is capable of facilitating the scheduling, rescheduling, transfer of flight tickets and effective use of flight information.

III. SIGNIFICANCE OF THE STUDY

The proposed system will enhance an efficient ticket reservation system which will aid the operations and activities of airline service providers. The economy of the organization will be affected positively because of the cost effectiveness of the proposed system. The findings of this research can also help the management of airline service providers to increase the income generation and smooth running of their everyday activities. Also, it will bring about improvement as well as provision of effective air transport services, allowing ticket reservation agents to have unprecedented patronage.

The Distributed Airline Reservation System (DARS) is a software application to assist an airline with transactions related to making ticket reservations, which include booking, reserving, cancelling and rescheduling tickets. From the viewpoint of the airline, the system is to provide the following services amongst others:

- i. Minimize repetitive work done by the system administrator and reservation clerks;
- ii. Maintain consistency among different access modes, example by phone, by web, at the information desk and across different physical locations. The users should be taken through the same steps by the system as they go through in conventional desk-reservation systems;
- iii. Maintain customer information in case of emergency, example flight cancellation due to stormy weather. The data gotten can also be used by the airline company to track customer's preferences and travel patterns to serve them better, plan routes for better marketing and efficient scheduling of flights;
- iv. Increase awareness among frequent travelers about various special offers and discounts;
- v. Minimize the number of vacant seats on a flight and maximize flight capacity utilization;
- vi. Maintain the capability to adopt a flexible pricing policy. The price of the tickets

should be dynamically determined based on the number of days, weeks or months before the date of the scheduled flight.

IV. RESEARCH METHODOLOGY

The development methodology adopted for the proposed system is a waterfall model. The waterfall model proceeds from one phase to the next in a sequential manner. It comprises of the following phases: requirements determination, requirements analysis, system design, implementation, testing and evaluation as shown in figure 1.

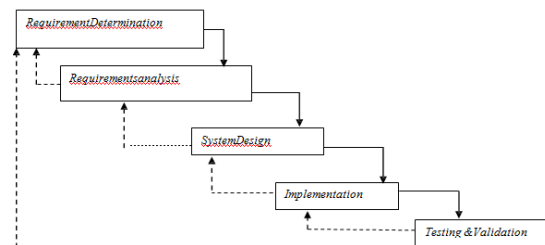


Figure 1: The Proposed System Design Model

The waterfall methodology is adopted based on the following reasons:

- i. The study is a predictable one in which all the requirements are clearly defined and can be estimated accurately, to avoid maintenance problem, the waterfall model is used.
- ii. The upfront investment is not risky to make.
- iii. The researchers focus their performance measures on delivery date and budget.
- iv. The customer knows exactly what they want by being able to accurately define all requirements and nothing changes other than bug fixes.
- v. Progress is more easily measured, as the full scope of the work is known in advance.

4.1 Analysis of the Existing Airline Reservation Systems

- i. The manual airline reservation system allows customers or passengers to fill forms manually and submit to the person in-charge of the process of assigning seats to passengers. Most times, the officer in – charge finds it difficult to assign the appropriate seat to the passengers and sometimes one particular seat is assigned to two passengers, or a duplicate of seats is assigned to one passenger, thereby causing

- ii. Whenever any requisition comes to the counter for a ticket to be issued, the ticket capacity is checked whether the required quantity of the tickets is available or not. If the required tickets are available, then the ticket is issued and an update to the reservation information is done to the ticket Issue Register.
- iv. The quantity of tickets is manually checked regularly in order to ascertain if there are missing tickets, if so, the process of issuing the ticket is cancelled. If the fare is increased or decreased, then changes are made into the fare book. Also, if a new flight is introduced, then an entry is made on a relevant book. This process also applies to flight schedules.

4.2 Limitations of the existing airline reservation systems

From the viewpoint of the airline staff and users, the existing system has the following limitations:

- i. The system cannot minimize repetitive work done by the system administrator and reservation clerks.
- ii. The system does not maintain customer information properly in case of an emergency, for instance, flight cancellation due to bad weather.
- iii. The system does not minimize the number of vacant seats on a flight in order to maximize flight capacity utilization.
- iv. The system requires more human efforts and leads to frustration for travelers in scheduling a trip, especially by increasing the efforts required to search for the flight they need to take.
- v. Making reference to records most times becomes a problem because some of the records are not easily found.
- vi. It creates an avenue for doubt on the capability of the company by the customer or clients and the effort wasted in duplication often leads to lack of interest in the job.
- vii. Maintaining and managing data is very costly and time consuming, because there are many documents that have to be maintained by each branch and copies have to be transferred to relative branches.
- viii. Transfer of information within the branches is costly and time consuming.

4.3 Requirements Analysis of the Proposed System

The proposed distributed online airline reservation system is a system that is capable of handling flight

schedules, flight destinations and their prices, flight time, seat reservation, transfer of flight ownership, an editing/updating features to edit stored customer information, cancelling of flight reservations, SMS alerts to notify booked flights or changes in flight schedule, a FAQ section to clarify issues regarding the customer's flight reservation and show alternative links to other partner airlines.

The system was developed with functional and non-functional requirements.

4.3.1 Functional Requirements

The following requirements are captured for the intended use of the system.

User account: The registered user can directly do the booking of flights and if there is a new user, he may register or he only sees the flight details. But for the reservation of a ticket, he must register first.

Creation of new user account: When there is a new customer, he/she should fill the form containing fields like Name, Address and Contact No. , Gender, Email id, User ID and Password.

Checking Availability: To check the available flight, the user should input the city where the flight will take off from, destination city, the date and time of journey.

Reservation of Flight: After providing all the information, the system will ask the user for confirmation. After confirming the information, the seat is reserved.

Canceling / Rescheduling of Ticket: To cancel the reservation, the customer should provide the details about ticket number and flight number, date and time of flight.

4.3.2 Non-functional requirements

The proposed system was designed to fulfill the following non-functional requirements.

Performance Requirements: Performance of the system is dependent on the bandwidth of the internet and also on the hardware used.

Security Requirements: There is only one authorized person who can see the customer's confidential information apart from the customer himself. The information of the customer is only available for the administrator.

Software Quality Attributes: The system is user friendly, interoperable and flexible.

4.4 High Level Model of the proposed system

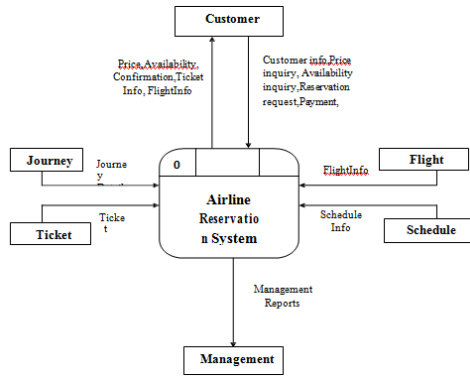


Figure 2: High Level Model of the Proposed Distributed Airline Reservation System

Figure 2 illustrates the high level model of the proposed system. It comprises the customer module, the journey module, the flight module, the ticket generation module, the schedule module and the management module. The modules have functional dependences and are integrated as the airline reservation system.

The system works as follows:

- i. The customer should register in order to proceed to book ticketservice.
- ii. The customer needs to input all the required details during the registration process.
- iii. Upon successful registration, the customer can proceed to book for flight.

4.5 Justification for the Proposed System

The proposed system is designed in such a way that it is able to meet up and achieve its set objectives for airline companies in Nigeria. This is made possible by overcoming all the problems that were traceable to the old system of operation. The outcome of this study will provide a basis for developing the appropriate approach to solving problems associated with air traveling operations in relation to Airline Flight Information System (AFIS).

- i. The system will provide an online airline reservation information system to facilitate online booking and flight scheduling.
- ii. The system is capable of handling transfer of flight tickets from one user to another prior to the time of flight.
- iii. The system gives users the ease in rescheduling their flights and enables them to have more control over their time of flight.
- iv. The system has the ability to accommodate users who have not booked their flights but

may want to travel within some minutes or hours.

- v. The system has the capability to make available a Frequently Asked Questions section to handle any enquiries users may have about their flights.
- vi. The system can enable the Airline company manage their customers' information in a way that is more efficient.

V. RESULT AND DISCUSSION

The result of this study is a Distributed Airline Reservation System with an easy-to-use web-based Graphical User Interface (GUI) for both the airline administrators' and customers. The system execution sequence is divided into the User environment and the Administrator environment

5.1 Userenvironment

a) WelcomePage

This appears when the URL of Aero Airline is typed into any web browser. While on this page, customers can either choose to search for a flight and continue to book flights, view flight schedules, view their journey details and access **the about us** and **contact us** pages as shown in figure 3.



Figure 3: Welcome Page

5.2 Registration Form

This form is used by customers (passengers) to register before booking a flight. To access this page, the customer needs to search for a flight. If the flight is available, the customer can then access the registration page or choose the next available flight before accessing the registration page as shown in figure 4.



Figure 4: Search Flights Interface

5.3 Customer SearchForm

This interface can be accessed on the home page. On this interface, the customer is required to enter his or her confirmation code to find his/her record. This record gives detailed information of what was entered during the registration; it also provides any booking and flight information if any as shown in figure 5.

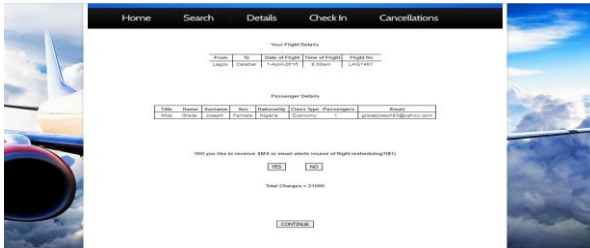


Figure 5: Customer Details Interface

5.4 Customer Search Result Interface

This interface is as a result of a successful search for a customer's record. This interface contains all the information that was entered during registration and any other flight, ticket, schedule and journey information in case the customer had already booked a flight. This interface is accessed by entering the correct confirmation number and clicking on **checkrecord** as depicted in figure 6.



Figure 6: Customer Information Interface

5.5 Journey Interface

This interface is accessible by both registered and non-registered users to view journey details. It is accessed by clicking on the **Journeys link** on the top menu of the system.

5.6 Flight Booking Form

This is accessed by clicking on flight reservations on the flights page. This form is used by the registered customers to book flights. All fields on this form are mandatory; hence the user is expected to fill all the fields. The available flights for booking are displayed after this as illustrated in figure 7.



Figure 7: Available Flights Interface

5.7 Ticket Booking Form

This interface is accessed by clicking on the ticket reservations link button on the Flights page. This form is used by registered customers to book and reserve tickets. All fields on this page are mandatory and hence the user is expected to fill all of them.

5.8 Ticket Details Interface

This interface appears after a successful ticket booking process. The user is required to note the ticket Id/confirmation number as it will be used during flight booking. The user can as well edit his flight information or reschedule his flight after booking as illustrated in figure 8.



Figure 8: Edit Flight Information Page

5.9 Administrator's Environment

This is a restricted environment; it is used by the administrator to change the content of the database. It is accessed by clicking on the administrator link on the system menu. Access to this environment requires an admin password. The login interface is shown in figure 9. Once the correct admin password is entered, the admin will have access to modify/delete and control the operation of the system in the home page. On this interface, the administrator can schedule flights, edit ticket information, change passwords, update journey details, schedule details, change database passwords and control every aspect of the system.



Figure 9: Login Page

After successful login, the administrator has privileges to view and modify the database, and approve travel tickets for customers who have subscribed and made payment.

This form is used by the administrator to add tickets to the system; Tickets added here can then be available for booking by the customers. It can also be used for viewing booked Tickets, update ticket information and delete tickets.

VI. CONCLUSION

Nowadays competition is so fierce between airlines that there are lots of discounts and a lot of luxuries given to customers that will give an edge to that particular airline if it adopts cutting edge technologies to provide customer services. The distributed airline reservation system developed in this study automates the processes of booking airline tickets online, provides users with flexible request processing, thus reducing the time wasted as well as the errors that are involved in the manual process. Though there may be the problems of limited validity, hidden fees to deceive customers and limited options, the distributed airline reservation system designed has far reaching benefits than the existing system.

From the researchers view, the distributed airline reservation system is one of the best innovations that can be applied in airline industry and all airline companies are encouraged to embrace the technology or lose patronage those who have already embraced it. Today, airlines are under unprecedented pressure to produce economic results or perish as fuel, labour, and asset costs escalate and demand declines. The failure to adopt the emerging technology in distributed airline reservation can cause airline operators failure to produce returns on investment that that can exceed capital costs.

The future success of an airline will be decided, in part, by its ability to harness emerging technologies to deliver superior customer experience and engender loyalty while empowering employees and improving operational efficiencies. The timing could not be better: new products and innovations in mobility are emerging as one of the most promising areas for airlines to transform their business models and operations.

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