

Czech University of Life Sciences Prague

Faculty of Economics and Management

Department of Information Engineering



Bachelor Thesis

Online Airline Ticketing System

Author: Iqra Ishtiaq

Supervisor: Ing. Petr Hanzlik, Ph.D.

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Systems Engineering and Informatics
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Thesis title

Online Airline Ticketing System

Objectives of thesis

The aim of this thesis is to create an airline ticketing system web application. Partial goal will be to assess existing airline ticketing solutions, and explain the typical mechanisms used.

Methodology

The methodology of the thesis is based on analysis of technical and scientific sources focusing on web development, UI design and user experience, and analysis of existing airline ticketing systems. Based on the synthesis of the gained knowledge, a prototype web application will be developed to improve user experience.

The proposed extent of the thesis

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css, html, database, web application, web designing

Recommended information sources

David Sawyer McFarland. CSS: The Missing Manual, 4th Edition. O'Reilly Media, 2015. ISBN-13: 978-1491918050

Krug, Steve. Don't Make Me Think, Revisited: A Common Sense Approach to Web Usability (3rd Edition), New Riders. ISBN 978-0321965516

Murach, Joel, HARRIS Ray. Murach's PHP and MySQL: a beginner's guide to HTML, CSS, JavaScript, and web graphics. 2nd edition. Fresno, CA: Mike Murach and Associates, [2014]. ISBN 978-189-0774-790.

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The Bachelor Thesis Supervisor

Ing. Petr Hanzlík, Ph.D.

Supervising department

Department of Information Engineering

Electronic approval: 25. 11. 2019

Ing. Martin Pelikán, Ph.D.

Head of department

Electronic approval: 25. 11. 2019

Ing. Martin Pelikán, Ph.D.

Dean

Prague on 15. 03. 2021

Declaration

I declare that I have worked on my bachelor thesis titled "Online Airline Ticketing System" by myself and I have used only the sources mentioned at the end of the thesis. As the author of the bachelor thesis, I declare that the thesis does not break any copyrights.

In Prague on 15/03/2021

Iqra Ishtiaq

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ONLINE AIRLINE TICKET RESERVATION SYSTEM

Abstract

This thesis deals with the airline reservation system, its history, development, and functions. It starts with understanding e-Commerce and then discovers how the airline reservation system is a part of its industry. Furthermore, it recognizes how far the ticket booking system has come from the start of its time. The main focus of the thesis is to develop a basic web application for an airline that deals with customers who wish to book a ticket for a flight. To achieve this, research is done to better help understand how the airline reservation system operates.

Keywords: Online booking system, eCommerce, web applications, database, HTML, CSS, PHP, MySQL, ARS.

ONLINE SYSTÉM REZERVACE LETENEK

Abstrakt

Tato práce se zabývá rezervačním systémem leteckých společností, jeho historií, vývojem a funkcemi. Začíná to porozuměním elektronickému obchodování a poté zjišťuje, jak je rezervační systém leteckých společností součástí jeho odvětví. Dále si uvědomuje, jak daleko systém rezervace letenek přišel od začátku své doby. Hlavním cílem práce je vyvinout základní webovou aplikaci pro leteckou společnost, která se zabývá zákazníky, kteří si chtějí rezervovat letenku. K dosažení tohoto cíle se provádí výzkum, který má pomoci lépe porozumět fungování rezervačního systému letecké společnosti.

Klíčová slova: Online rezervační systém, eCommerce, webové aplikace, databáze, HTML, CSS, PHP, MySQL, ARS.

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List of abbreviations

| Abbreviation | Words |
|---------------------|--|
| CRS | Computer Reservation System |
| ARS | Airline Reservation System |
| PSS | Passenger Service System |
| HTML | Hypertext Markup Language |
| WWW | World Wide Web |
| CSS | Cascading Style sheet |
| PHP | Hypertext Preprocessor |
| SQL | Structured Query Language |
| RDBMS | Relational DataBase Management System |
| XAMPP | Cross-platform, Apache, MySQL, PHP, Perl |

1. Introduction

The world continues to grow, with innovations in current technology, which make our life easier. The same growth has been witnessed in the airline industry. Nowadays, air travel has become a norm, which has given people a chance to experience a life that could only be dreamt of a decades ago. This acceptance has led to the modernization of the way ticket reservation functions over the years.

Tickets are a document that provides the possessor with some rights. They are issued by the airlines to the passengers who have booked a seat on the aircraft. The passengers make use of these tickets to board the airplane. In the late 1950, Airlines started the use of a computer reservation system (CRS) to modernize their ticket booking system. This was done in the hope to get real-time details of the booking to be the most efficient.

A ticket booking system is a sophisticated software that allows the airline to supervise flight schedules, passenger reservations, ticket records, etc. Modernization in this process has led to the development of numerous software we currently use to book our plane tickets. Nowadays it has almost become essential for airlines to offer online booking as it is far more convenient than contacting a travel agent or any other means.

This thesis will review what the airline reservation system (ARS) is and how it operates. The literature review discusses what e-commerce is and how the ARS is a part of it. It further looks into the system developed and what kind of programs and software are used to build it. The practical part examines the step-by-step development of the prototype of the web application. To help conclude SWOT (strength, weakness, opportunity, threat) analysis is performed to analyze the functionality of the web application.

2. Objectives and Methodology

2.1. Objectives

The main objective of this thesis is to develop a web application that can allow customers to make a booking. To fulfill this objective it is important:

- To understand what ARS is.
- To understand the working mechanism of ARS.
- To understand what software and programs are used to create it

2.2. Methodology

The methodology of the thesis is based on analysis of technical and scientific sources focusing on web development, UI design and user experience, and analysis of existing airline ticketing systems. Based on the synthesis of the gained knowledge, a prototype web application will be developed to improve user experience.

3. Literature Review

3.1. Evolution of eCommerce

eCommerce is an abbreviation used for the term ‘Electronic Commerce’. Electronic commerce is a type of business model that allows businesses and individuals to buy or sell products or services over the Internet. It has become one of the most utilized means of buying. Over the last decade, eCommerce has given a boost to the retail industry. Entrepreneurs from all over the world have favoured the idea of online selling more and more, as it has become a means for businesses to save an incredible amount of expenses. Whereas customers find it pleasing as they can get lower rates, the convenience of shopping from the comfort of their own home, and increased selections of products and services.

One of the examples of eCommerce includes online ticket booking. This industry has gotten immense since the start of its time. One of the leading reasons for such an evolution could be considered due to how much easier it has gotten now to book a ticket compared to the late 1960s.

3.1.1. Airline ticket booking system

In 1960, if someone had to book an airline ticket, they would have to contact a travel agent. *“A travel agent would find a suitable flight in the printed schedules published by individual airlines and telephone the airline-booking agent to make a reservation. At a later time, the airline booking agent would return the call to confirm the reservation, or to suggest an alternative flight if no seats were available. The airline paid the agent a flat commission fee for the booking.”* (Gasson, 2003, pp. 239-240)

However those days are now long gone, the ARS has now been modernized. The airline now uses an operating system called passenger service system (PSS), which acts as a mediator in the transactions between the customers and the airline. PPS is a multiplex structure that consists of a collection of applications that deal with its customer activities. One of the software that is a part of PPS is the ARS.

The introduction of ARS was one of the primal shifts made to be more efficient. This system is responsible for the administration of all flight-related activities. Over time ARS matured into CRS. CRS was formally developed to facilitate airlines but eventually, other industries like travel agencies and other ticket reservation platforms began to adopt it with the use of a Global distribution system.

One of the first ARS was created in the 1960s called ‘semi-automated business research’ (SABRE), later though airlines started to work on their own ARS. Some of the best ARS that exist nowadays are, Amadeus Altea Suite, Videocom, Rusada, Crane PAX, and Merlot aero.

3.1.1.1. Working Mechanism of Airline reservation system

The passengers can reserve their flight tickets by visiting the airline’s website that offers e-booking. They can look for flights by exploring and choosing a destination, providing their details, and eventually proceeding to make an online payment.

After the compilation of these tasks, a confirmation email is then sent to the passenger with an e-ticket. The details of the booking are recorded in the airline database, which is a part of PSS. This operating system then makes the booking visible for airports, airline companies, and travel agencies.

3.1.1.2. Effect of corona virus on the Airline Industry

2020 became the year when e-commerce was blooming. This was due to the global pandemic, coronavirus. Being forced to stay home provoked the buyers to incorporate the use of eCommerce in their daily life like e.g. ordering groceries online to stay safer. However, this prospering effect was not felt by all eCommerce.

Since the start of the pandemic, the countries went on lockdown one after the other. This meant heavy restrictions on air travel for most countries and a complete shutdown for the others. According to some statistics, worldwide air travel went down by 46.4% on Oct 12, 2020, in comparison to Oct 14, 2019. Whereas for some countries the decrease of scheduled flights was over 90%. This meant heavy losses were endured by many airlines.

3.2. Programming Languages and Softwares Used

3.2.1. Programming Languages Used

3.2.1.1. HTML

HTML (Hypertext Markup Language) is a well-known markup language. This programming language is used to create world wide web (WWW) pages by tagging text and different forms of media. Its name 'Hypertext' comes from the term hyperlinks that are included inside the HTML code. A hyperlink can be a word, a sentence, or even a form of media that connects the code to a new web page or document.

HTML was first developed in 1993 by Sir Tim Berners-Lee. Since then this markup language has had many versions, the latest variation is labeled HTML5.

3.2.1.2. CSS

CSS (Cascading style sheet) is used to design the different tags and elements of markup Languages for WWW pages. It was first developed in 1992 and has since become very widely used. Over the years CSS has had many versions, the latest one is 'CSS3'. Nowadays practically all browsers can function with this programming language.

Since CSS is used to style web documents, It can be used to give a color theme, change the font and style of the text, and help design many other characteristics of the website.

3.2.1.3. PHP

PHP (Hypertext Preprocessor) is a programming language mostly used for web development. It was introduced in 1994 by Rasmus Lerdorf. Since its early days there have been many versions of PHP, The Latest one created PHP 8.0.3.

PHP is HTML embedded, which indicates that PHP code can be inserted or written inside an HTML document. Such files are saved using a '.php' tag. When a .php file is run, the output of the PHP code is laid out as HTML for the WWW pages to read. Acquiring such characteristics makes PHP documents safer for tasks like maintaining a database connection than others. This makes PHP a great choice for working with websites that require good concurrence with databases like ARS.

3.2.1.4. SQL

SQL (Structured Query Language) is a programming language operated in a way that assists in correspondence with the database. Databases are structured data stored in a computer, they can store information about records, products, employees, customers, and many more.

SQL is used by most businesses to give structure and maneuver the data collected by them. It was developed in 1970 by IBM researchers Raymond Boyce and Donald Chamberlin, At the time SQL was known as SEQUEL.

3.2.2. Software Used

3.2.2.1. PHPMyAdmin + MySQL

PhpMyAdmin is a web application created with PHP to operate MySQL, a relational database management system (RDBMS) that has SQL integrated inside it. RDBMS is a software that acts as a connecting tool between a database and its user. This allows the user to manipulate and modify the data inside the database.

The first release of PhpMyAdmin was in 1998, this version was numbered as '0.9.0'. Fast Forward to today, after many updates and bug fixes, PhpMyAdmin has its current version called '5.1.0'.

3.2.2.2. XAMPP

XAMPP (Cross-platform, Apache, MySQL, PHP, Perl) is a web development bundle developed by Apache Friends initiative in 2002. Apache is a software that serves as a server. It can also be used as a testing ground for programmers to test their web locally. This is done through the use of a loopback IP address '127.0.0.1', which does not send information on the internet for the world to see.

Perl (Practical Extraction and Report Language) is a programming language that develops web applications. Perl was first introduced in 1987 by Larry Wall. At that time its purpose was to make report processing easier. However, in 2000, another man named Raku got into redesigning Perl and created it for what it is now. Most programmers prefer using Perl to write documents for web servers. XAMPP with the help of the software it offers creates an environment for users who are using their personal computer to test the web applications.

3.2.2.3. Setting up Xampp & PhpMyAdmin for web development

To prepare the appropriate environment for the web development, XAMPP version 8.0.0 was used. In XAMPP the softwares used were Apache and MySQL.

The process of setting up XAMPP for the backend coding starts with opening the XAMPP application. After the application is opened, both the module services needed can be initiated by clicking the action buttons for Apache and MySQL shown in green highlighting. We can determine if the Application did start by the message shown in the message box.

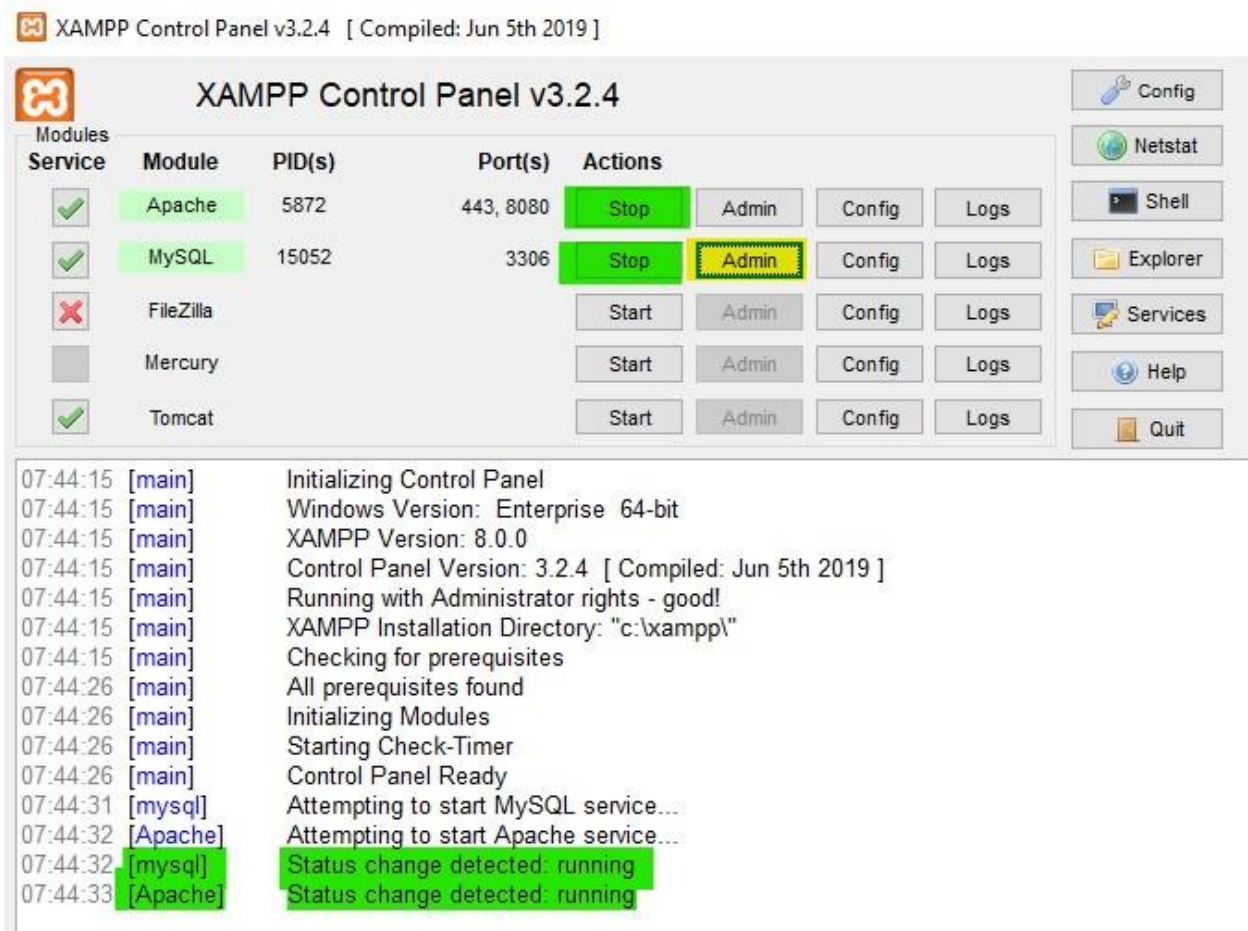


fig.1.1 XAMPP connection

After securing a connection to the Apache server, PHPMyAdmin is accessed through XAMPP by clicking the Admin button shown in yellow highlighting in fig 1.1. We can start the web application and are taken to the default page of PHPMyAdmin. In fig 1.2 we can access the databases by selecting the one needed on the left hand side menu.

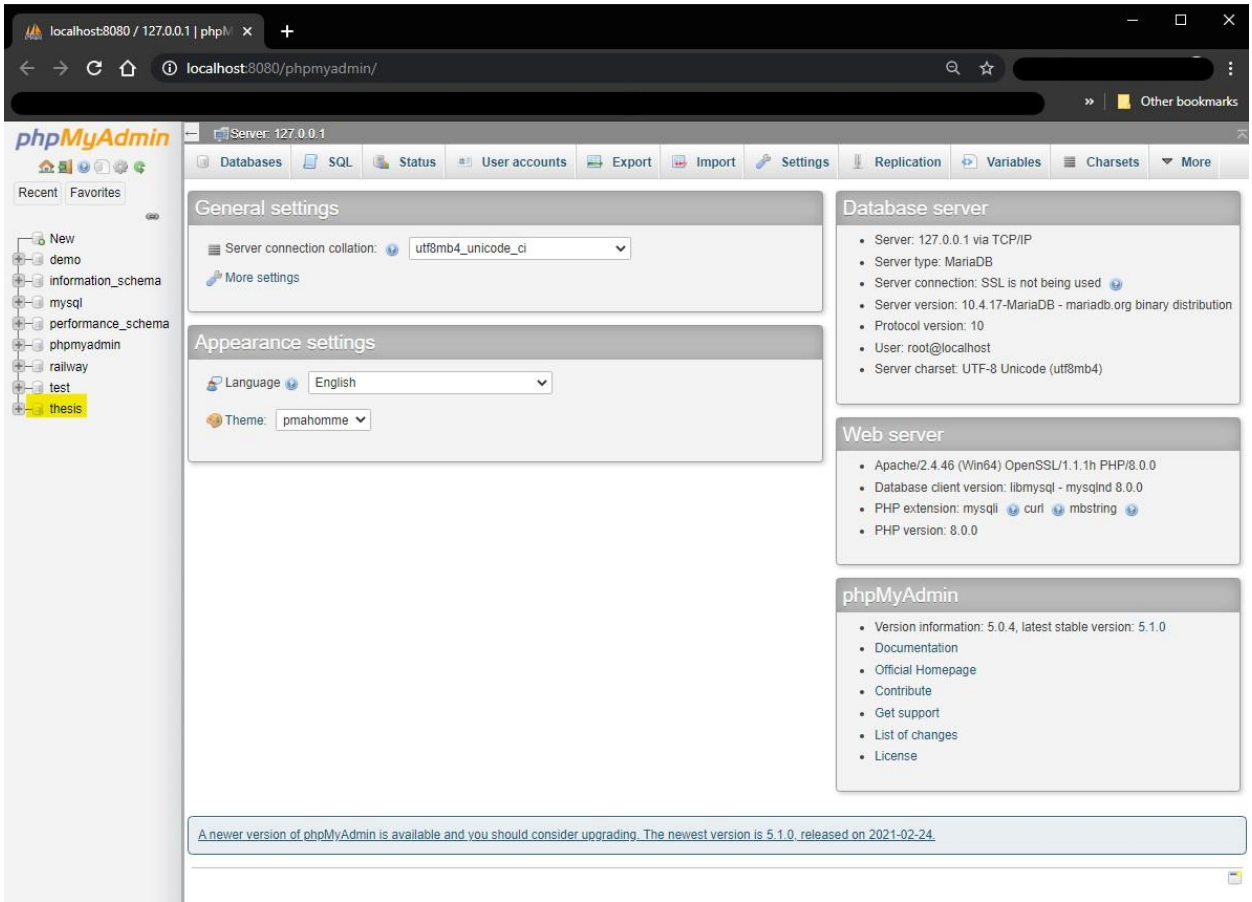


Fig.1.2 Default page of PHPMyAdmin

4. Practical Overview

The practical part of the thesis is going to discuss the development of a website for ticket reservations. Starting with the user personas to show the possible customers, then the front end to show how the website is designed, its code and how the user can interact with it. And finally the backend to discuss how the website operates on the server, its database connection and the code used.

4.1. User Personas

To help better explain the interactivity between the website and users, 2 personas are outlined:

4.1.1. Persona 1

Name: Rose

Gender: Female

Age: 21

Place of Residence: Copenhagen, Denmark

Marital Status: Single

Background: Rose is a university student studying in Barcelona. Her days are mostly busy with all the assignments, readings and lectures at university, This makes her always on the hunt for alternatives that would make her work more time effective. Any time in the evening is preferred by her to be spent relaxing with her friends.

Rose is from Denmark, where her family resides. She is very attached to her parents who are in their late 60s. She prefers to visit them every chance she gets. Rose loves ARS like *CZU AIRLINE* that makes tasks like booking her ticket to visit her parents easy and effective.

Typical Day: Rose wakes up at 6 am to go for a run, After her run she comes back, has a light breakfast and leaves for university. On Mondays her classes can last until 5 pm, so she has a quick lunch during a short break at 12pm and continues her class till the end. After she is finished with university, Rose goes out for drinks with her roommate and a few friends where she gets a meal to fill her up. She hangs out with them for a few hours

to relax and heads back to the dorms at 8 pm. She then does any chores that might have been piling up, talks to her parents before bed and goes to sleep around 11pm.

4.1.2. Persona 2

Name: Liam

Gender: Male

Age: 27

Place of Residence: Budapest, Hungary

Marital Status: Relationship

Background: Liam is a Database Administrator in Budapest. He has been working for this company for a few years now and enjoys it but has been thinking about asking to get a transfer to the company's Berlin branch. Liam is currently in a long distance relationship and his girlfriend lives in Berlin. This has made Liam travel to Berlin quite a lot in the past few years. Liam who is a constant user of ARE loves the use of sites like *CZU AIRLINE* that make booking hassle free for him.

Typical Day: Laim wakes up at 7 am to get ready for work. He prefers a light breakfast and loves to take packed lunches with him to work. He leaves for work around 8:30 and the transit from his car takes him 30 min to get to the office. He works till 5pm and then heads to his gym. Liam works out for a bit and then heads back home around 8pm.

Typically he eats leftovers for dinner and then after watching netflix for a bit goes to bed at 11pm.

4.1.3. UseCase

UseCase is a narration of different scenarios a user can encounter on your website and how they might perform in it. Here we have 3 different scenarios outlined:

4.1.3.1. Scenario 1

A user who does not know *CZU Airline* will presumably be directed towards it through a search engine or marketing campaign when looking to travel. In this case the user would look up the flight search to see if there are any flights to their desired destination. If yes they will either

move forward and book the ticket or hold back to do their research on the competitor airline's website.

If the users has determined to book the flight, they would select the record matching their demand and proceed to passenger details. There the user will fill in the required details and confirm their booking.

4.1.3.2. Scenario 2

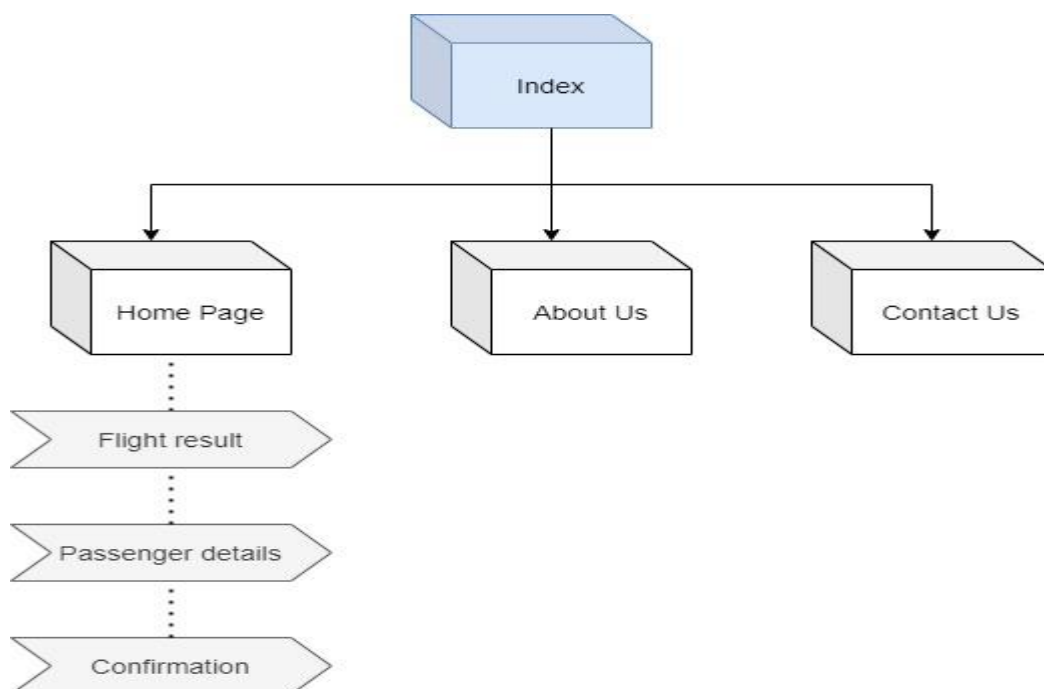
The user is a routine customer of *CZU Airline*. They are familiar with the website and how it works. The user would search the destination they are looking to travel at, select the available flight, and proceed to book their ticket.

4.1.3.3. Scenario 3

The user needs to contact *CZU Airline*. It can be because they have traveled with *CZU Airline* and have a complaint or some query. The user opens the website and selects the 'Contact Us' webpage from the index. There the user proceeds to fill in their worry and sends the email.

4.2. Frontend of Website

The Front end of the website consists of HTML and CSS code used to construct the webpage. The website consists of 3 main webpages mentioned in the index. The homepage is the only web document that has subpages as it guides the user to make a booking. The construction of the index is in the graph below.



4.2.1. Header

The header of the page is a constant constraint in all web pages, It consists of the company's logo and index to other web pages linked titled, 'Homepage', 'About Us' and 'Contact Us'.

4.2.1.1. Use of HTML for header

In this code, The yellow highlighting shows how the ‘a’ tag which is used along with the ‘href’ attribute creates hyperlinks in the index to be able to connect the web pages together. The red highlighted box shows the use of ‘img’ tag which is used along with other attributes as shown in the fig. 2.1 to insert the company’s logo.

```
47 <header>
48 <div class="container">
49 <a href="HomePage.php">
50 
51 </a>
52 <nav>
53 <ul>
54 <li><a href="HomePage.php">Home</a></li>
55 <li><a href="AboutUs.php">About Us</a></li>
56 <li><a href="ContactUs.php">Contact Us</a></li>
57 </ul>
58 </nav>
59 </div>
60 </header>
```

Fig2.1 HTML code for the Header

4.2.1.2. Use of CSS for header

The Fig 2.2 shows the CSS code used for styling of the index, The yellow highlighting shows an example for the styling done using some tags namely ‘body’, ‘header’ and ‘nav’.

The classes created in html are applied for styling in CSS such as the highlighted red box shows in Fig 2.2. To further design the header, the tags were targeted more thoroughly such as the tags ‘nav ul’ shown in the green highlighted box which represents the styling for unordered list element (ul) inside the navigation tag.

```
1 body{
2   margin: 0;
3   background: #ffffff;
4   font-family: 'Work Sans', sans-serif;
5   font-weight: 500;
6 }
7
8 .container{
9   width: 88%;
10  margin: 0 auto;
11  color: white;
12 }
13
14 header{
15   background: #649CBC;
16 }
17
18 header::after{
19   content: '';
20   display: table;
21   clear: both;
22 }
23
24 .Logo{
25   float: left;
26 }
27
28 nav{
29   float: right;
30 }
31
32 nav ul{
33   margin: 0;
34   padding: 0;
35   list-style: none;
36 }
37
38 nav li{
39   display: inline-block;
40   margin-left: 70px;
41   padding-top: 70px;
42 }
43
44 nav a{
45   color: white;
46   text-decoration: none;
47   text-transform: uppercase;
48 }
49
50 nav a:hover{
51   color: #336480;
52 }
```

Fig2.2 CSS code for the Header

4.2.1.3. UserInterface for header

The end result of such coding for the header gave the results shown below in Fig 2.3. The logo shown on the header allows the users to click on it to reach back to the homepage from anywhere on the website.

The index has 3 web pages, Home, About Us and Contact Us, and the user can click on any of the names to open the corresponding webpage. When the mouse is hovered over the values of the index, the CSS is designed to change the color of the writing to a darker color like shown in fig 2.2.



Fig2.3 UI for the Header

4.2.1.4. About Us

When the user selects 'About Us' from the index they are brought to this webpage. This page contains a header and footer as all others. The main property of this webpage is the paragraph that outlines a bit of information about the airline. This page is a static webpage.

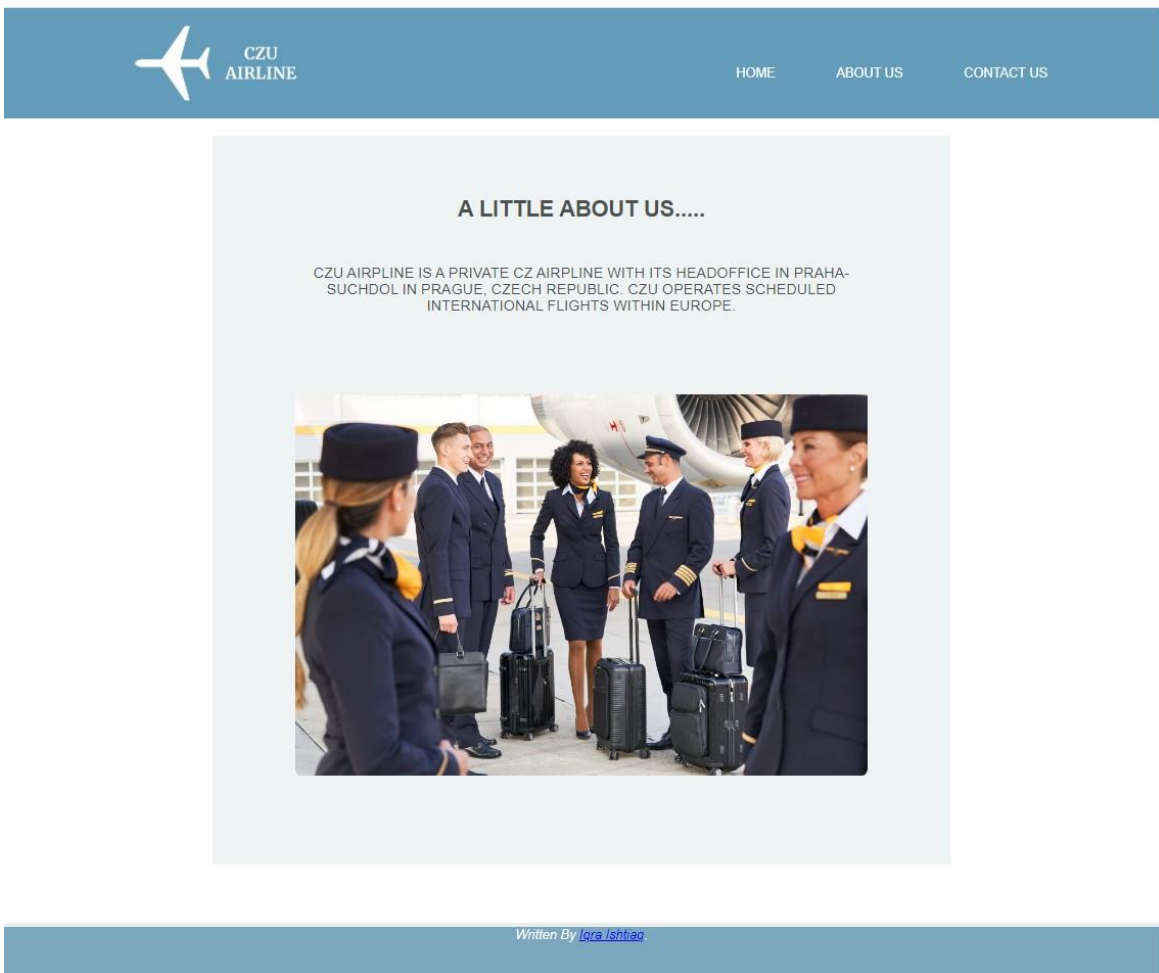


Fig2.4 UI for About US

4.2.1.5. Contact Us

This section is best explained with the use of scenario 3, when the user selects ‘Contact Us’ from the index they are brought to this webpage. Here the user can fill in required columns to try and contact the airline for any queries they might have.

The image shows a web browser window displaying the 'CONTACT US' page for CZU AIRLINE. The top navigation bar is blue with the airline's logo and name on the left, and links for 'HOME', 'ABOUT US', and 'CONTACT US' on the right. The main content area has a light blue background and is titled 'CONTACT US'. It contains a form with three input fields: 'NAME:' with the placeholder 'Enter Your Name', 'EMAIL:' with 'Enter Your Email', and 'SUBJECT:' with 'Type Message'. Below the subject field is a 'SEND Email' button. At the bottom of the page, there is a footer with the text 'Written By |@ra_ishitag'.

Fig2.5. UI for Contact Us

4.2.2. Home Page

The Home page is the main page of the website where the users are expected to start off, The fig 3 shows snippets of the html code, design layout and the User Interface we achieved. The main component of this page is the table available for the users to search for available flights for booking on the aircraft.

4.2.2.1. Use of HTML code

The basic structure of the HTML pages usually consists of tags like ‘html’, ‘head’, ‘body’ and ‘footer’. The ‘html’ tag is used to help interpret the root of the HTML

document. The 'head' tag is used to hold the data about the HTML document. The data inside this tag is called metadata which consists of characteristics of the HTML document. Anything inside the head tag is not showcased on the web pages.

Unlike the head tag, anything inside the 'body' tag is what is laid out on the web pages. For this code the inside of the body starts with the 'header' tag which was previously discussed, it then moves on to a 'form' tag which is associated with the 'table' tag to create a box for the users to search for available flights.

Another table is created after this to display content about different services and news about the airline. The code ends with a footer which like the header is consistent in all web pages.

```
36
37 <html lang="en" xmlns="http://www.w3.org/1999/html">
38
39 <head>
40 <meta charset="UTF-8">
41 <title>Airplane Reservation System</title>
42 <link href="Style.css" rel="stylesheet" type="text/css">
43 </head>
44
45 <body>
46 <!--Navigation Bar -->
47 <header>
48 <div class="container">
49 <a href="HomePage.php">
50 
51 </a>
52 <nav>
53 <ul>
54 <li><a href="HomePage.php">Home</a></li>
55 <li><a href="AboutUs.php">About Us</a></li>
56 <li><a href="ContactUs.php">Contact Us</a></li>
57 </ul>
58 </nav>
59 </div>
60 </header>
61
62 <!-- Airplane reservation system -->
63 <form action="FlightResults.php" method="post">
64 <table class="AirPlaneReservation">
65 <thead>
66 <tr>
67 <th>Book Your Flight With Us</th>
68 </tr>
69 </thead>
70
71 <tbody>
72 <tr class="TripType">
73 <td>
74 <input type="radio" class="TripTypeButton" name="check" value="One Way">
75 <span>One Way</span>
76 </td>
77 <td>
78 <input type="radio" class="TripTypeButton" name="check" value="Round Trip">
79 <span>Round Trip</span>
80 </td>
81 </tr>
82 <tr class="DropDownList">
83 <td>
84 <label>Flying From:</label>
85 <select name="FlyingFrom">
86 <option value=""> </option>
87 <option value="Prague">Prague</option>
88 <option value="Berlin">Berlin</option>
89 <option value="Hungary">Hungary</option>
90 <option value="Barcelona">Barcelona</option>
91 <option value="London">London</option>
92 <option value="Paris">Paris</option>
93 <option value="Denmark">Denmark</option>
```

Fig3.1. HTML code for Homepage

```

108         </select>
109     </td>
110 </tr>
111
112 ▶ ...
123 ▼ <tr class="AgeGroup">
124 ▼ <td>
125     <input type="radio" class="AgeGroupButton" name="Age" value="Adult">
126     <span>Adult (18+)</span>
127 </td>
128 ▼ <td>
129     <input type="radio" class="AgeGroupButton" name="Age" value="Children">
130     <span>Children (2-17)</span>
131 </td>
132 ▼ <td>
133     <input type="radio" class="AgeGroupButton" name="Age" value="Infant">
134     <span>Infant (0-2)</span>
135 </td>
136 </tr>
137 ▼ <tr>
138 ▼ <td>
139     <label>Travel Class</label>
140 ▼ <select name="TravelClass">
141     <option value=""> Select </option>
142     <option value="BusinessClass"> Business Class </option>
143     <option value="EconomyClass"> Economy Class </option>
144 </select>
145 </td>
146 </tr>
147 <td class="ShowFlightButton">
148 ▼ <input type="submit" name="insert" value="SHOW RESULTS"/>
149 </td>
150 </tr>
151 </tbody>
152 </table>
153 </form>
154
155 <!--Images and description on Homepage -->
156 <table class="HomePageDescription">
157 <tr>
158 <td>
159 
160 </td>
161 <td>
162 
163 </td>
164 <td>
165 
166 </td>
167 </tr>
168 <tr class="ImageDescription">
169 <td>
170 <td> We offer multiple inflight entertainment like on board wifi,<br>
171 <td> Music to chill, and latest movies to keep you and your young<br>
172 <td> ones happy through out the flight.
173 </td>
174 </tr>
175 </table>

```

Fig3.2. HTML code for Homepage

```

176 <td> We offer facilities like generous leg room, comfortable seats<br>
177 to complimentary drinks and snacks to make the journey one of<br>
178 your finest. </td>
179
180 <td> Travel safely with CZU airline, throughout the journey we have<br>
181 taken advance safety measure to ensure our customers safely<br>
182 during this hard time of pandemic.
183 </td>
184 </tr>
185 </table>
186 <!--Footer with author, email -->
187 ▼ <footer>
188 <address>
189     Written by <a href="mailto:iqraishtiaq123@gmail.com">Iqra Ishtiaq</a></address>
190 </footer>
191 </body>
192 </html>

```

Fig3.3. HTML code for Homepage

4.2.2.2. CSS for Homepage

The Fig3.4. showcases some of the CSS code which was used to decorate the Homepage. The code presents how some of the tags, classes and different input fields which were used in HTML were enhanced. The color theory chosen for the whole website is monochromatic shades of blue, this was chosen to keep the webpage more minimalistic and pleasant for the users.

```
54 .AirPlaneReservation{
55   background-color: #e9eef0;
56   height: 580px;
57   width: 900px;
58   margin: auto;
59   padding: 20px;
60   opacity: 0.7;
61   font-size: 18px;
62   border: 22px #fff solid;
63 }
64
65 th{
66   text-transform: uppercase;
67   color: #383d3d;
68 }
69
70 .TripType .TripTypeButton{
71   margin: 20px 10px 20px 0;
72   box-shadow: none;
73   cursor: pointer;
74 }
75
76 .AgeGroup .AgeGroupButton{
77   margin: 20px 10px 20px 0;
78   box-shadow: none;
79   cursor: pointer;
80 }
81
82 Button{
83   background-color: #336480;
84   color: #fff;
85   font-size: 16px;
86
87   border-radius: 0.5rem;
88   padding: 0.6rem 0.8rem;
89   align-content: center;
90   border-width: 10px;
91   border: 10px solid;
92   border-radius: 15px;
93 }
94
95 input{
96   color: darkslategray;
97   padding: 10px;
98   font-size: 16px;
99   border: none;
100  border-radius: 0.5rem;
101  padding: 0.6rem 0.8rem;
102  align-content: center;
103 }
104
105 input[type="submit"] {
106   background-color: #336480;
107   color: azure;
108 }
109
```

Fig3.4. some CSS code for Homepage

4.2.2.3. UserInterface for Homepage

The Homepage contains a box that allows the users to search for available flights. This webpage is where customers in scenario 1 and scenario 2 are expected to start their case.

They commence their search by filling in the required inputs and eventually click the 'Show result' button.

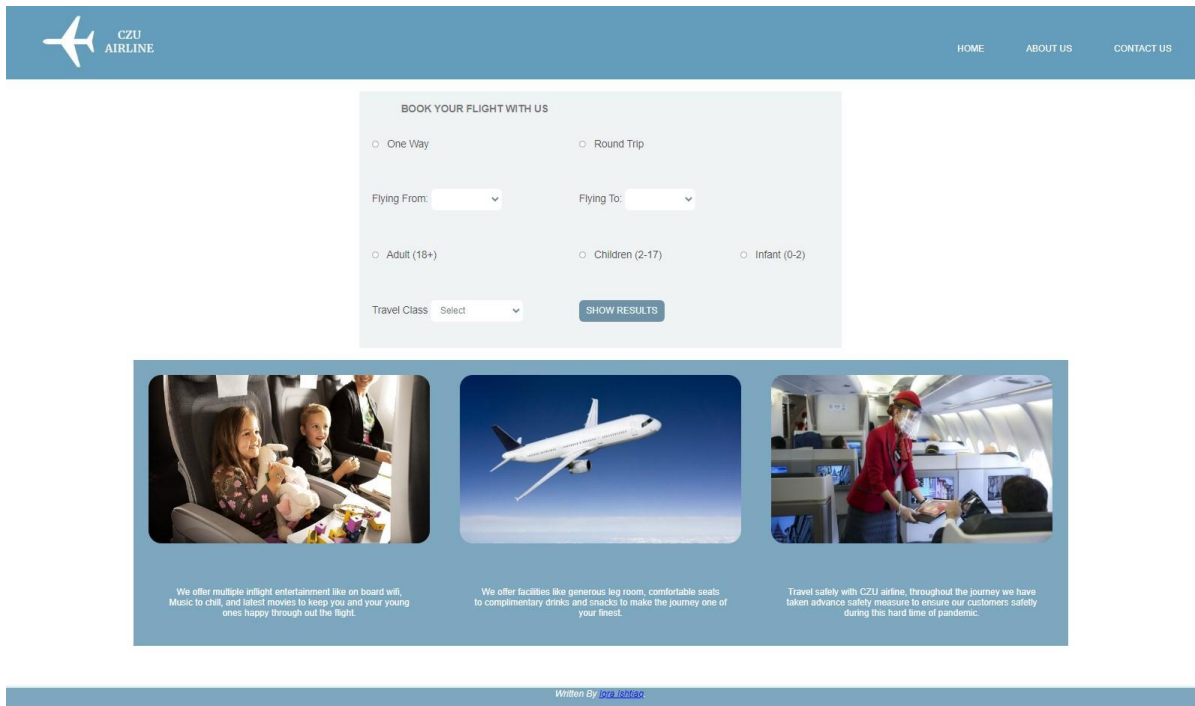


Fig3.5. UI for Homepage

4.2.3. Flight Results

After the 'Show result' button is clicked on the homepage the customers are taken to the flight results webpage. This webpage shows the corresponding results to the flight the user was looking for and provides an option for them to select it. The fig 4 shows snippets of UI for the web document.

Go Back

FLIGHT AVAILABLE

| DEPARTURING AIRPORT | ARRIVAL AIRPORT | FLIGHT DETAILS |
|-----------------------|-----------------|--------------------------------------|
| <input type="radio"/> | PRAGUE | BARCELONA 2021-02-01 08:15:00.000000 |

BOOK FLIGHT

Fig. 4. UI for list of Flights Available

4.2.4. Passenger Details

After the customer selects the flight and proceeds with the 'Book Flight' button, they are directed to this webpage. The document at the top exhibits the details of the flight that was previously selected and then instructs them to fill in their personal details. All the fields are compulsory to fill in before moving forward. After filling in the requirements the user can click the 'Send Confirmation' button.

Booking details for flight id: 7 -> from Prague to Barcelona at 2021-02-01 06:15:00.000000

PASSENGER DETAILS

Firstname: Surname:

Email:

Male Female Other

Date Of Birth:

Nationality:

Written By: [Cezar Lăbăș](#)

Fig 5. UI for passenger details

4.2.5. Confirmation

After the user is ready and clicks ‘SEND CONFIRMATION’, they are taken to this webpage. The webpage shows them a small message from the airline that shows gratitude for the booking and directs them to their Email for the e-ticket.

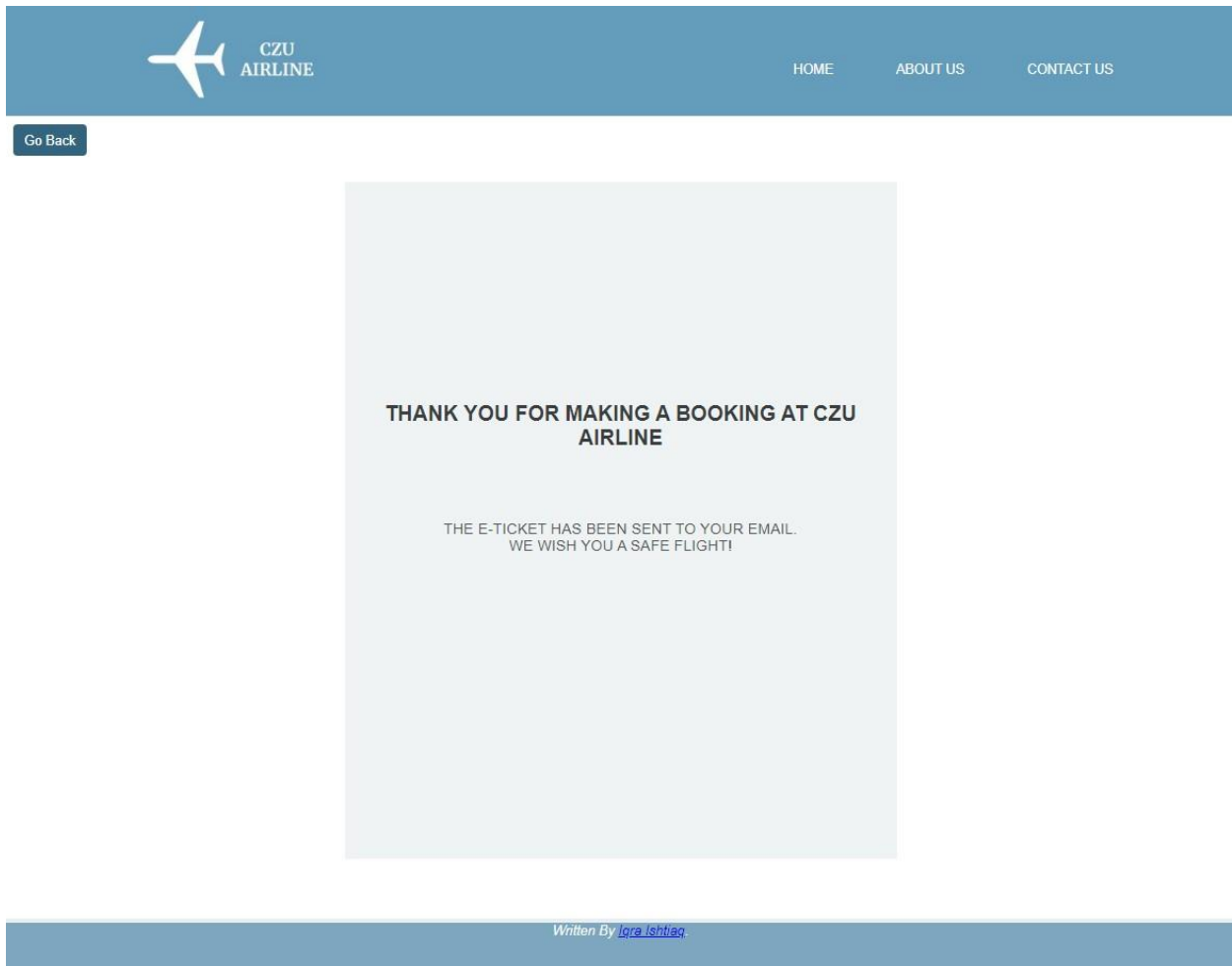


Fig. 6. UI for Message of Confirmation

4.3. Backend of Website

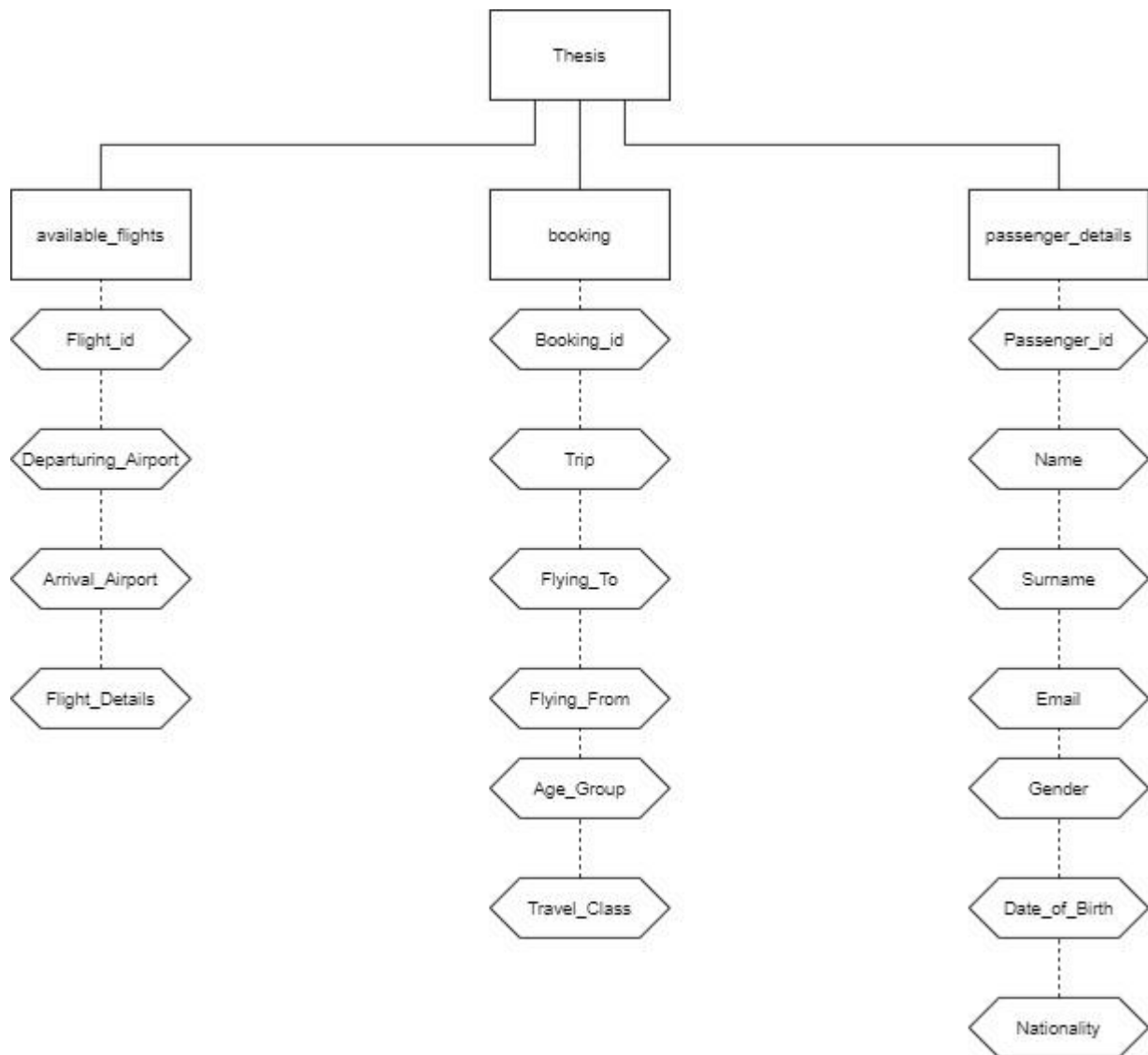
The backend of the website consists of a server, database connection and code to function the website. The programming languages that were used were PHP and MySQL. Some softwares that were used were XAMPP, PhpMyAdmin and Brackets as the code editor.

4.3.1. Database

The database for *CZU AIRLINE* was created in MySQL via PhpMyAdmin, the name of the database is 'Thesis' and it has 3 basic tables. The name of the 3 tables are, 'available_flights', 'booking', and 'passenger_details'. The table 'available flights' include timetables of flights scheduled by *CZU AIRLINE*.

The table 'booking' stores all the data the customers search for at the homepage when searching for flights. And the table 'passenger_details' stores all the passenger information

added when the user is finalising their booking. The graph 2 below shows the structure of the database and the data columns in each table.



Graph.2 Structure of the database 'Thesis'

4.3.1.1. Database ER Diagram

Graph 3 below shows the database entity relationship diagram (ERD) for *CZU AIRLINE*. The diagram consists of entities named, 'passenger', 'booking', 'Available_Flights'. The entities consist of different attributes, the one attribute that connects them is 'Foreign key'. Foreign keys are aspects of the table that connect to the primary key of a different table. Entity can only have 1 primary key and its value can never be NULL. The lines connecting the tables show the kind of relationships these entities have with each other, for eg.

'passenger_details' and 'booking' have a 1 to Many relationship. This is denoted with the use of this '1 to Many' association symbol shown below in fig.7.1. The association symbol helps show how one attribute in 'passenger_details' is connected to many attributes in the 'booking' table.

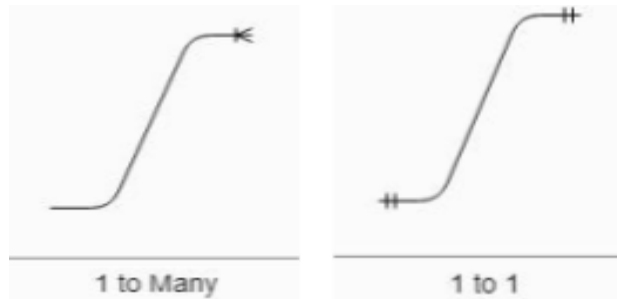
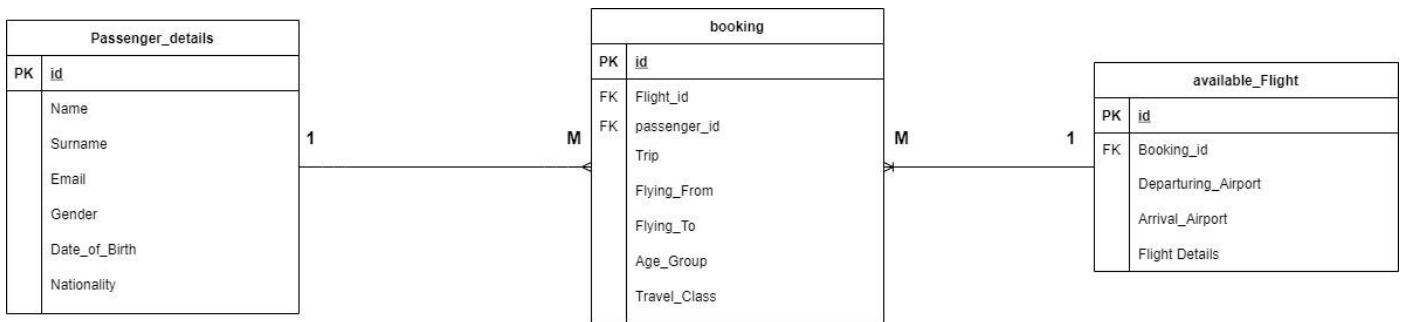


Fig.7.1 Association symbols used in ERD

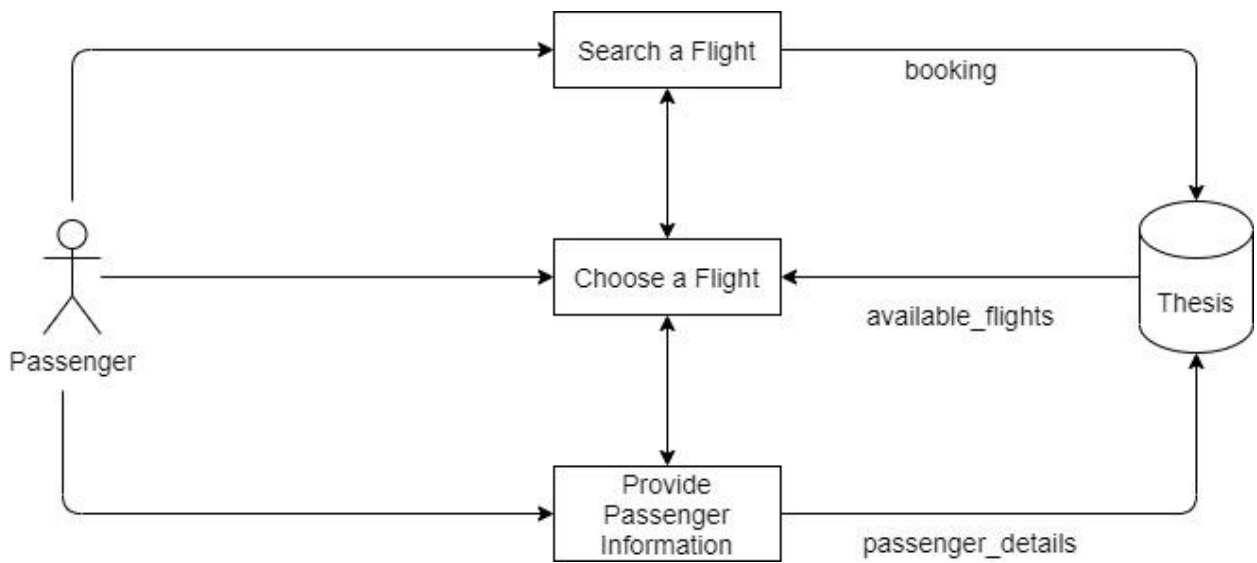


Graph..3. CZU AIRLINE database ER Diagram

4.3.1.2. PHP

The graph 4 presents when the passenger's interaction with the website associates with the database. This happens on 3 occasions, when searching for a flight, when choosing a flight and when the passenger provides information for the booking.

While searching for a flight and the input of passenger details stores data inside the database, the data available in the available flights table is called out to the webpage. This is done with the use of PHP.



Graph 4 Workflow of the website

First, PHP is used to secure the connection to the database ‘Thesis’ by using the localhost server. This is done by creating a new file called ‘DbConnection.php’. Since the connection is needed in every file accessing the database, Fig 8.2 shows the code used to link this document to the needed.

```

DbConnection.php
1  <?php
2
3  $Db = mysqli_connect("localhost", "root", "", "thesis");
4
5  ?>
  
```

Fig.8.1 Database Connection

```

4  <?php
5
6  include('DbConnection.php');
7
  
```

Fig.8.2 Database Connection linked in other document

Then, PHP was used to store data provided by the user. This as mentioned before was done for 2 web pages, ‘Homepage’ and ‘Persnoal_Detail’. However, the main component of this application is the function of flight results shown according to the search results. This is made possible by calling the latest entry from the ‘booking’ table in the database and matching it to all

the records available in 'available_flights'. After the matching flight is found it is presented on the webpage within a table tag.

```
61
62     <?php
63
64     $final_array = array();
65
66     $latest_id = $Db->insert_id;
67     $booking = "SELECT * FROM booking WHERE Booking_id = $latest_id";
68     $latest_booking = mysqli_query($Db, $booking);
69     $latest_booking_result = mysqli_fetch_array($latest_booking);
70
71
72     $flights = "SELECT * FROM available_flights";
73     $available_flights = mysqli_query($Db, $flights);
74
75     while ($row = mysqli_fetch_array($available_flights)){
76         if ($row["Departuring_Airport"]==$latest_booking_result["Flying_From"] and
77             $row["Arrival_Airport"]==$latest_booking_result["Flying_To"]){
78             array_push($final_array,$row);
79         }
80     }
81
82     foreach($final_array as $fa){
83
84     ?>
85         <tr class="FlightResultHeading">
86             <th colspan="2"> Departuring Airport </th>
87             <th> Arrival Airport </th>
88             <th> Flight Details</th>
89
90         </tr>
91         <tr class="FlightResultInfo">
92             <td>
93                 <input type="radio" class="TripTypeButton" name="check" value="<?php echo
94                 $fa["Flight_id"] ?> ">
95             </td>
96             <td>
97                 <?php echo $fa["Departuring_Airport"] ?><a> </a>
98             </td>
99
100            <td>
101                <?php echo $fa["Arrival_Airport"] ?>
102            </td>
103
104            <td>
105                <?php echo $fa["Flight_Details"] ?>
106            </td>
107        </tr>
108
109    <?php
110    }
111    ?>
```

Fig.8.3 PHP for calling data from database and presenting it on web page

5. Results and Discussion

As the world continues to grow, being able to travel by air has become a necessity. Some travel for personal reasons whereas some travel for professionals. In this thesis, the analysis of ARS was presented. It discussed its history and operation in today's world. Furthermore, it looked into the procedure of the development of a basic form of ARS.

5.1. Web Application Comparison

CZU Airline is a web application that implements the basic functions of ARS. It develops a connection with a database to store and retrieve information for users to make a reservation for the airline's aircraft. Unlike other web applications in this industry, *CZU Airline* misses functions like purchasing an e-ticket, online check-in, creating a user account for the web application to store passenger details, and access to choose a seat on the aircraft.

This illustrates the room for improvement and updates that can make this web application more efficient for the airline and user-friendly. Thus to truly grasp the functionality of *CZU Airline*, we performed a SWOT analysis.

5.2. SWOT Analysis

5.2.1. Strength

- Convenient and hassle free booking
- Can contact the airline if needed.
- Availability of booking on web browsers.

5.2.2. Weakness

- Does Not let the customers make an account to store their data for easy access
- No payment method attached.
- Limited flights
- Only available within Europe

5.2.3. Opportunity

- Ability to buy e-ticket on site.
- Ability to make an account for repeated customers.
- online check-in
- Allowing the customers to select their seat.

5.2.4. Threats

- Data is not secured.
- Loss of internet connection can force the user to start over.

6. Conclusion

This thesis focused on how ARS has emerged into being such an innovative and convenient tool today. It presents how ARS has added more convenience to this necessity, making it possible for clients to make a booking at any time, anywhere. The main aim of the thesis was to develop a web application that could function as an ARS. And to understand how this tool allows users a more efficient access to air travel. The objectives set out at the start of the thesis were:

- To understand what ARS is.
- To understand the working mechanism of ARS.
- To understand what software and programs are used to create it

To complete these objectives, research was done by studying different articles and journals. These studies revealed the history of ARS, the different stages it took to develop the current software and how it has flourished in not just the airline industry but in other industries e.g. railway, bus and tourism too. Then to properly understand the mechanism of ARS, different ARS websites were analyzed and researched. The result of this thorough analysis gave enough knowledge for the development of the web application. A basic website was developed that works successfully and acts as a good prototype to understand how ARS operates. Although the website possesses the weaknesses mentioned, the web application has been developed with preparation for future upgrades to satisfy the users.

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