AeroManageX

Database Management System

MSCS 542L-256

Aerotech Titans

Marist College

School of Computer Science and Mathematics

Submitted To:

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September 13, 2023

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Project Report of AeroManageX

1. Team Name

2. Aerotech Titans

Team Members

1. Bashir Dahir bashir.dahir1@marist.edu (Team Head)
2. Nihar Lodaya nihar.lodaya1@marist.edu (Team Member)
3. Marguerite McGahay marguerite.mcgahay@marist.edu (Team Member)

Description of Team Members

1. Bashir Dahir

I'm a Computer Science student at Marist College, Beacon, New York, in my fifth year, with just two semesters to go before graduation. My academic journey has sharpened my skills in programming and data structures, but my true passion lies in database management systems. Currently, I'm eagerly gearing up for a project focused on airline management systems, where I plan to apply my expertise in database management to create efficient and robust solutions for the aviation industry. Beyond academics, I enjoy problem-solving and community engagement.

2. Nihar Lodaya

Hey there, I'm Nihar Lodaya, and I come from India. I've got a bachelor's degree in computer science from back home, and right now, I'm in the middle of my master's program in Computer Science at Marist College. I'm stoked about working with this bunch of awesome folks on our current project. What really got me excited about my teammates Bashir & Marguerite is how dedicated they are to making this project a success.

3. Marguerite McGahay

I grew up in Poughkeepsie and then attended the University of Delaware, where I graduated in 2021 with a BS in Mathematics and a Minor in Computer Science. While I was there, I was a TA for multiple computer science classes and was also on the Women's Rowing Team! I currently work at Marist as the Assistant Women's Rowing Coach. This is my first semester in the Computer Science – Software Development program, so I don't know many people, but I was excited when Bashir and Nihar extended an invitation for me to be a member of this group. We selected our team head, Bashir, since it was his initial idea to pursue this project, but I truly believe each member of this team has the capability to be able to step into that role if asked of us.

3. AeroManageX Objective

The primary objective of the AeroManageX project is to elevate your airline's existing database infrastructure to be able to better compete with the world's top airlines. Our company will help you condense the mass amount of information needed to be able to have thousands of planes arrive and depart each day. Our system operates to help your airline in multiple ways, including but not limited to managing flight bookings, optimizing the cost of flights, making sure planes are in the necessary airports based on different flights' place of departure and arrival, and efficiently assigning pilots to flights that make sense for your company and their schedules.

4. Review Related Works

There are many competitions for our company including Ramco Aviation, Airline Suite, and AvPro. Each of these companies has positive and negative aspects. To begin with, Ramco Aviation published on their website that they provide the best aviation software for the following three reasons: “Proven technology champions, usability focusses and in memory planning and optimization” (2). However, Ramco Aviation critics emphasize on their “Security and data control issues and difficulties of data migration” (*2*). Second, Airline Suite promotes that their system is easy to use, scalable and affordable. On the other hand, however, Airline Suite is notorious for having “no history of previous or editions and no import options for Microsoft Excel or file” (1). Finally, AvPro is famous for their “reliability reporting, budget forecasting, and inventory management” (4). On the contrary, AvPro lacks the availability of “instruction manuals and system stability” as there are system glitches (3).

5. The Merits of Our Project

Our company will provide airlines with more features than any other competitive company. We provide airlines with the ability to see and organize information which can be categorized into three principal operations:

Our Land Operations:

- Checked baggage: Each passenger has a bag that must be on their flight.
- Staff management: Such as gate-workers, baggage handlers, custodial staff, etc.
- Times of arrival and departure of flights
- Fleet inventory

Air Operations:

- Flight plan: Including non-stop flights and layovers.
- Assigning pilots and airline staff.

Billing Operations:

- Bookings: Secure database for credit card numbers.
- Cost of seats
- Checked luggage (including oversized): If a passenger checks a bag that is over 50lbs, they must pay an extra fee on top of the base cost.

An airline should choose AeroManageX to manage their data because we are security focused and can benefit any size airline, from companies with just a small fleet of planes to global “Aero-Titans"!

6. GitHub Repository Address

Here is our GitHub repository’s URL.

https://github.com/bashirad/MSCS-542L-256_AeroManageX_Aerotech-Titans.git

7. External ER Diagrams

Manager Description

In the External Entity Relationship Diagram for the Manager Model in our AeroManageX, the primary entities include Flight, Origin Airport, Destination Airport, Pilot, Flight Attendant, Plane, and Airline. Flight is the central entity, while Origin Airport and Destination Airport are directly connected to Flight, representing the departure and arrival locations. Pilots are associated with specific flights as they operate them, and Flight

Attendants work on board these flights. The Plane entity represents the aircraft used for the flights, and Airline serves as a parent entity encompassing various flights operated by the airline. This diagram illustrates how these entities are interrelated, providing a clear overview of the airline's operations.

Manager Model

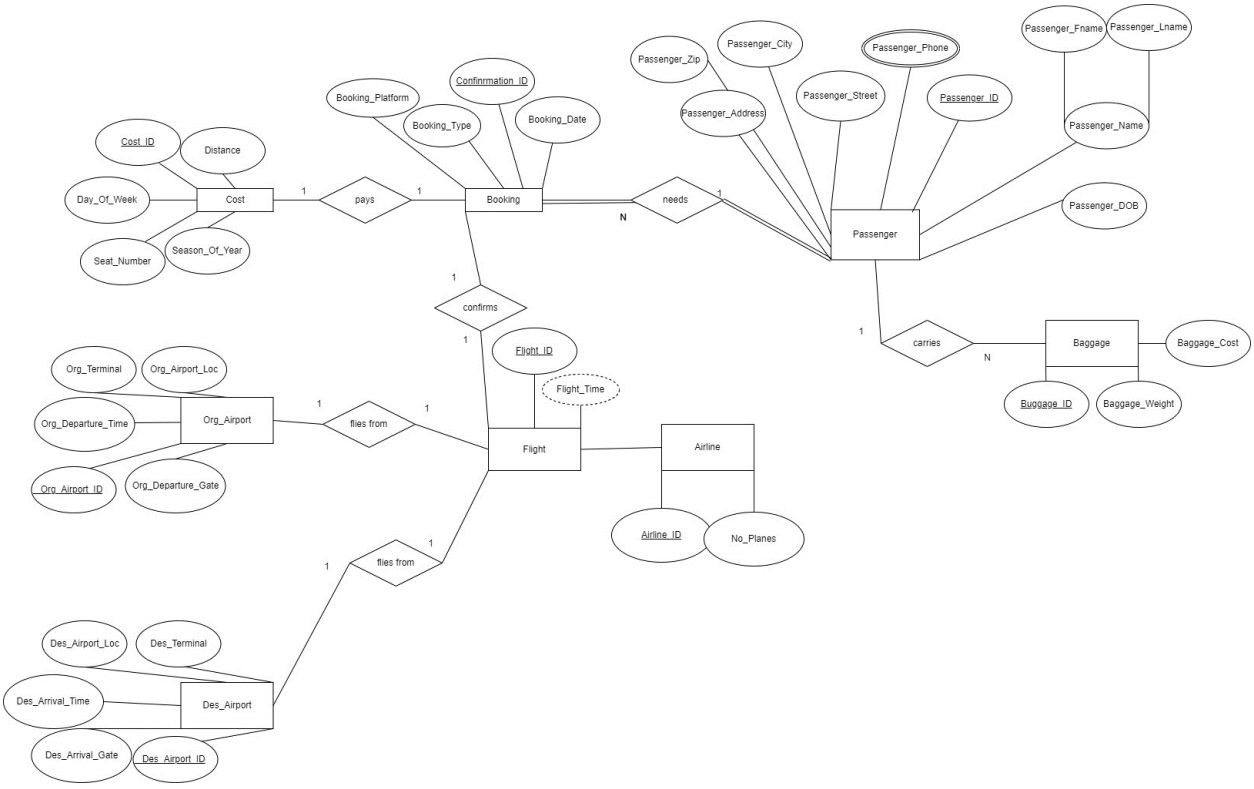


Figure 1

Booking Agent Description

In the External Entity Relationship Diagram for the Booking Agent Model in the AeroManageX, a web of interconnected entities and relationships emerges. Cost is linked to Booking, reflecting the financial transaction between booking agents and reservations. Booking necessitates Passenger, showing the connection between bookings and the passengers they are made for, while Passenger also carries Baggage, signifying the belongings associated with passengers. Bookings confirm Flights, illustrating the reservation process, and Flights are tied to both Origin and Destination Airports, representing the departure and arrival points of the journeys.

Booking Agent Model

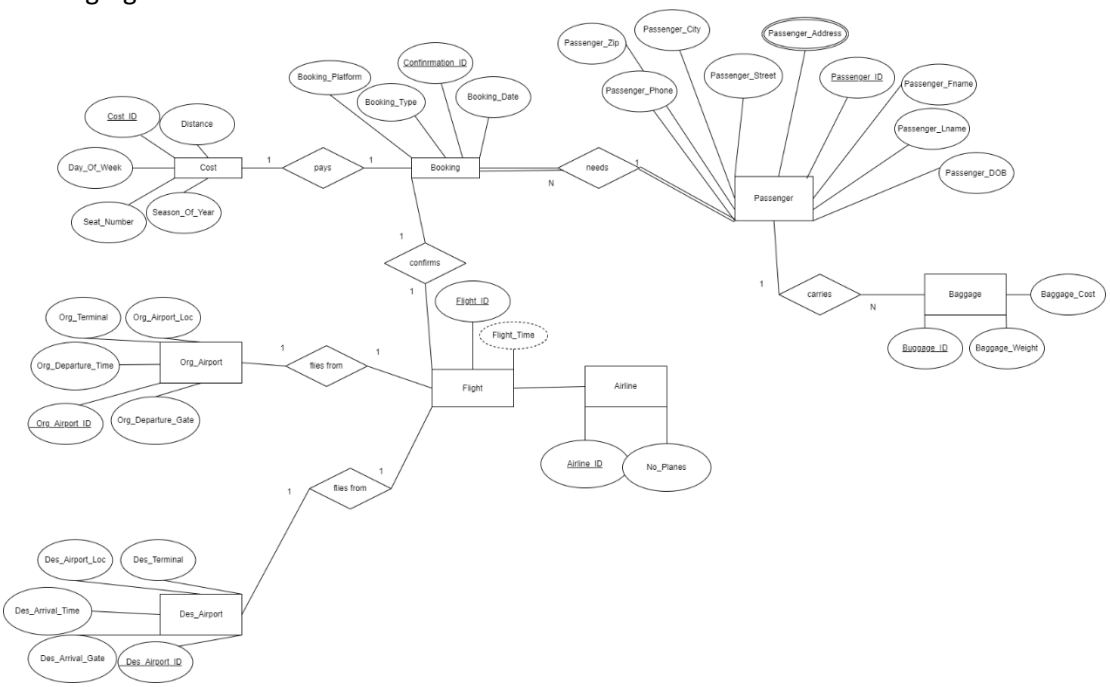


Figure 2

8. Entity Relationship Diagram (ER Diagram)

Description

Creating this project involves a thoughtful selection of entities, attributes, relationships, participations, and cardinalities to represent a simplified domain. In this case, the chosen entities include "Cost," "Baggage," "Booking," "Plane," "Flight," "Flight_Attendant," "Org_Airport," "Des_Airport," "Pilot," "Passenger," and "Airline." Each of these entities represents key elements in the domain of Airline travel. Attributes are then identified for each entity to capture relevant information; for instance, "Passenger" have attributes like Passenger_Fname, Passenger_Lname, Passenger_Address, etc. While "Cost" has attributes like Confirmation_ID, Distance, Season_Of_Year, etc. Relationships are established between entities to represent how they are connected, such as the relationship between "Booking" and "Passenger" to show that a passenger can make a booking.

Diagram

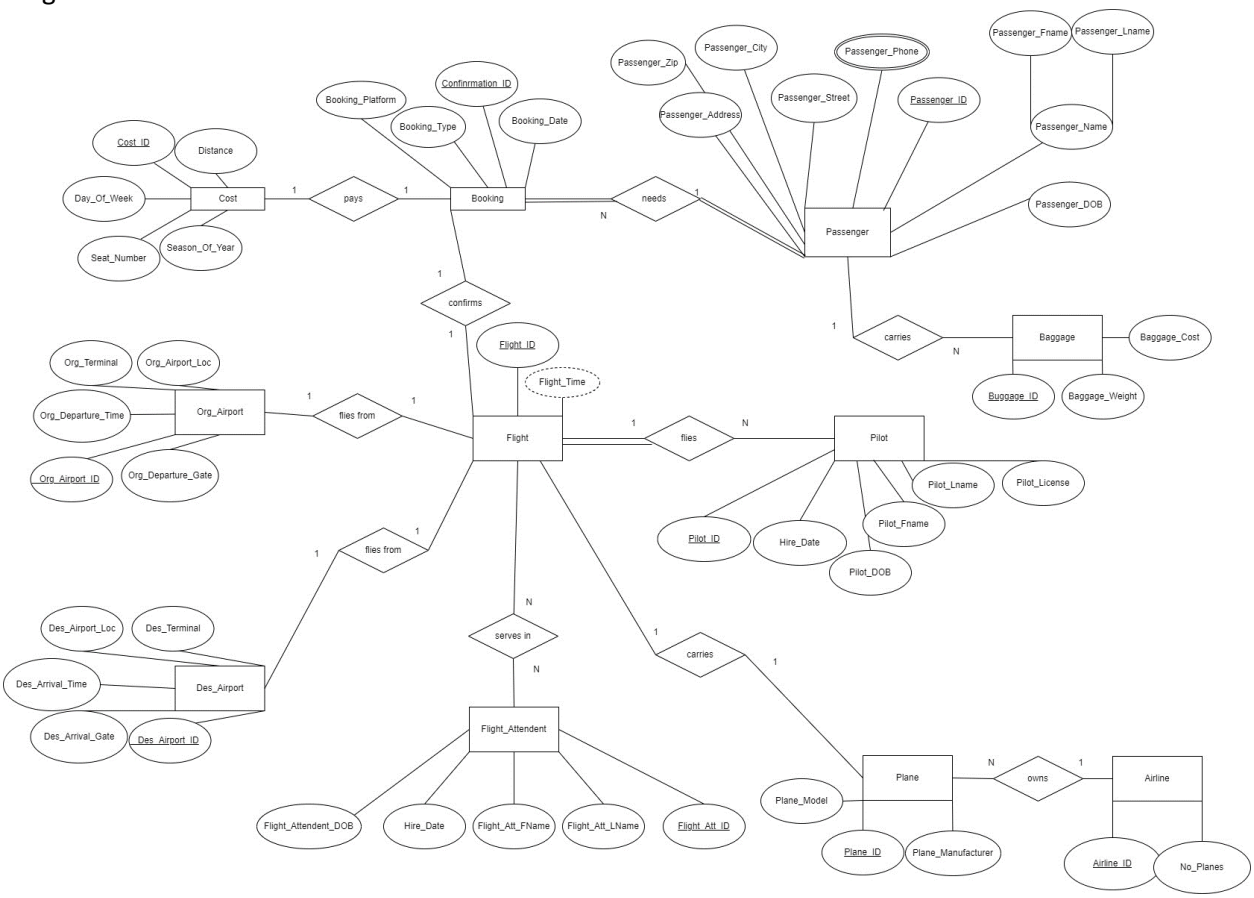


Figure 3

9. Enhanced Entity Relationship Diagram (EER)

Description

#	Entity	Key	Relationships
1	Flight	Flight_ID	Each flight has one origin airport, one destination airport, multiple bookings for their passengers, as well as a one plane, one pilot, and multiple flight attendants
2	Plane	Plane_ID	Each flight must have a plane, which owned by an airline
3	Airline	Airline_ID	Each airline has multiple planes in its fleet
4	Cost	Cost_ID	Cost is related to Booking via a 1-1 relationship.
5	Booking	Confirmation_ID	Each booking is related to a passenger, which results in a cost of

			booking. When a passenger books, they are then connected to a flight
6	Passenger	Passenger_ID	Each passenger can have one or more bags
7	Baggage	Baggage_ID	Each bag is related to one passenger
8	Org_Airport	Org_Airport_ID	Each flight must depart from one origin airport
9	Des_Airport	Des_Airport_ID	Each flight must arrive at one destination airport.
10	Pilot	Pilot_ID	Each flight must have one pilot. A pilot can have multiple flights in one day
11	Flight Attendant	Flight_Att_ID	Each flight can have multiple flight attendants and a flight attendant can have multiple flights in one day

Figure 4

Diagram

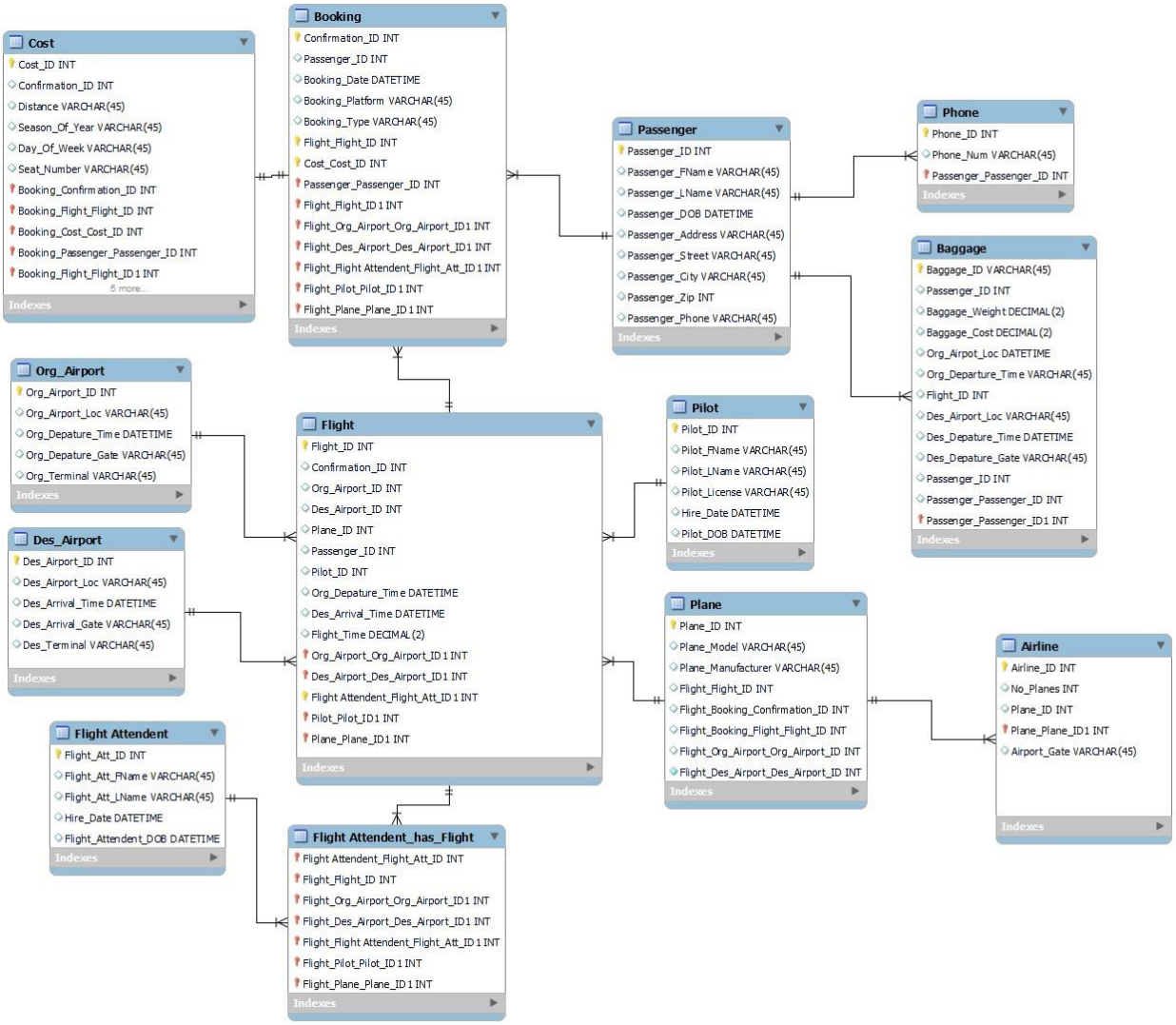


Figure 5

10. Database Development

Create database and tables.

```
DROP DATABASE IF EXISTS mydb;
CREATE DATABASE IF NOT EXISTS mydb DEFAULT CHARACTER SET utf8;
USE mydb;

-- GET RID OF ALL FOREIGN KEYS EXCEPT BOOKING'S CONFIRMATION_ID
-- Table mydb.Cost
DROP TABLE IF EXISTS mydb.Cost;
CREATE TABLE IF NOT EXISTS mydb.Cost (
  Cost_ID INT NOT NULL,
  Amount INT NOT NULL,
  Distance VARCHAR(45) NULL,
  Season_Of_Year VARCHAR(45) NULL,
  Day_Of_Week VARCHAR(45) NULL,
  Seat_Number VARCHAR(45) NULL,
  PRIMARY KEY (Cost_ID)
);
```

Cost
Airline
Passenger
Pilot
Des_Airport
Org_Airport
Flight_Attendent
Plane
Booking
Baggage
Flight
Flight_Attendent_has_Flight

11. Loading data and performance enhancements

Handling foreign key constraints

We used the following steps:

```
SET FOREIGN_KEY_CHECKS=0;

-- insert into Cost

INSERT INTO mydb.Cost (Cost_ID, Amount, Distance, Season_Of_Year,
Day_Of_Week, Seat_Number)

VALUES

      (1, 50, 100, 'Summer', 'Monday', 'A1'),

      (2, 60, 150, 'Spring', 'Wednesday', 'B3'),

      (3, 45, 180, 'Fall', 'Friday', 'C7'),

      (4, 55, 75, 'Winter', 'Tuesday', 'D2'),

      (5, 70, 750, 'Summer', 'Thursday', 'E5'),

      (6, 65, 1000, 'Spring', 'Monday', 'F9'),

      (7, 40, 325, 'Fall', 'Sunday', 'G4'),

      (8, 75, 650, 'Winter', 'Saturday', 'H6'),

      (9, 58, 3400, 'Summer', 'Tuesday', 'I8'),

      (10, 68, 140, 'Spring', 'Thursday', 'J10');

SET FOREIGN_KEY_CHECKS=1;
```

We set the foreign key checks to zero temporarily, so we could perform the insert operation without MySQL raising errors about the foreign key violations. Then we set it back to one to minimize the chance of data inconsistency in the future.

Importing data

Here is sample of data insertion:

```
-- Booking

INSERT INTO mydb.Booking (Confirmation_ID, Booking_Date,
Booking_Platform, Booking_Type, Passenger_ID)

      VALUES

      (1, '2023-10-31 10:00:00', 'Website', 'One-way', 101),

      (2, '2023-11-01 14:30:00', 'Mobile App', 'Round-trip', 102),

      (3, '2023-11-02 12:45:00', 'Website', 'One-way', 103),

      (4, '2023-11-03 08:15:00', 'Mobile App', 'Round-trip', 104),

      (5, '2023-11-04 16:20:00', 'Website', 'One-way', 105),

      (6, '2023-11-05 11:30:00', 'Mobile App', 'Round-trip', 106),

      (7, '2023-11-06 09:10:00', 'Website', 'One-way', 107),
```

```
(8, '2023-11-07 15:55:00', 'Mobile App', 'Round-trip', 108),
(9, '2023-11-08 13:25:00', 'Website', 'One-way', 109),
(10, '2023-11-09 17:40:00', 'Mobile App', 'Round-trip', 110);
```

Insertion optimization

Timing (as measured by the server):
Execution time: 0:00:0.00031280
Table lock wait time: 0:00:0.00000300

Normalization Check

All tables are in 1NF, 2NF and 3NF

12. Application Development

Graphical User Interface Design

Here's a brief outline of the capabilities provided in each page and the connections between them:

Start:

This is the initial page, likely serving as the entry point for the application. It doesn't have specific functionality but serves as a starting point for users.

Login Page:

Users can input their username and password to access the application. It serves as an authentication barrier for the application, ensuring only authorized users can proceed.

Main Menu:

After successful login, users are directed to the main menu. It likely provides options for various actions, including adding or removing flights, making bookings, and more.

Add Flight:

This page allows authorized users to input information for adding a new flight to the system. This is a feature for administrators or flight operators to update flight details.

Administration Set Password:

This page might be used by administrators to set or change passwords for authorized users or other administrators. It's a security and user management feature.

Remove Flight:

Allows administrators to remove flights from the system. It's a feature for managing flight data.

Make Booking:

Provides a form or interface for users to make flight bookings. Likely used by passengers or customers.

Search Flight:

Users can search for available flights based on specific criteria, like destination, date, or flight number. It assists users in finding suitable flights.

Delete Booking:

Allows users to cancel or delete their existing flight bookings. Provides a means for passengers to manage their bookings.

Change Password:

Enables users to change their own passwords for security reasons. Part of user account management.

Display Flight Details:

Likely shows detailed information about a specific flight, such as departure and arrival times, seat availability, and pricing. Helps users get more information about a particular flight.

Authorized?

It appears to be a validation step, where the application checks if the user is authorized. If authorization is successful, the user is directed to the "Access Granted" page. Otherwise, the user might encounter further login attempts.

Enter Username & Password:

This is part of the login process where users input their credentials for authentication. If successful, they are directed to the "Authorized?" page.

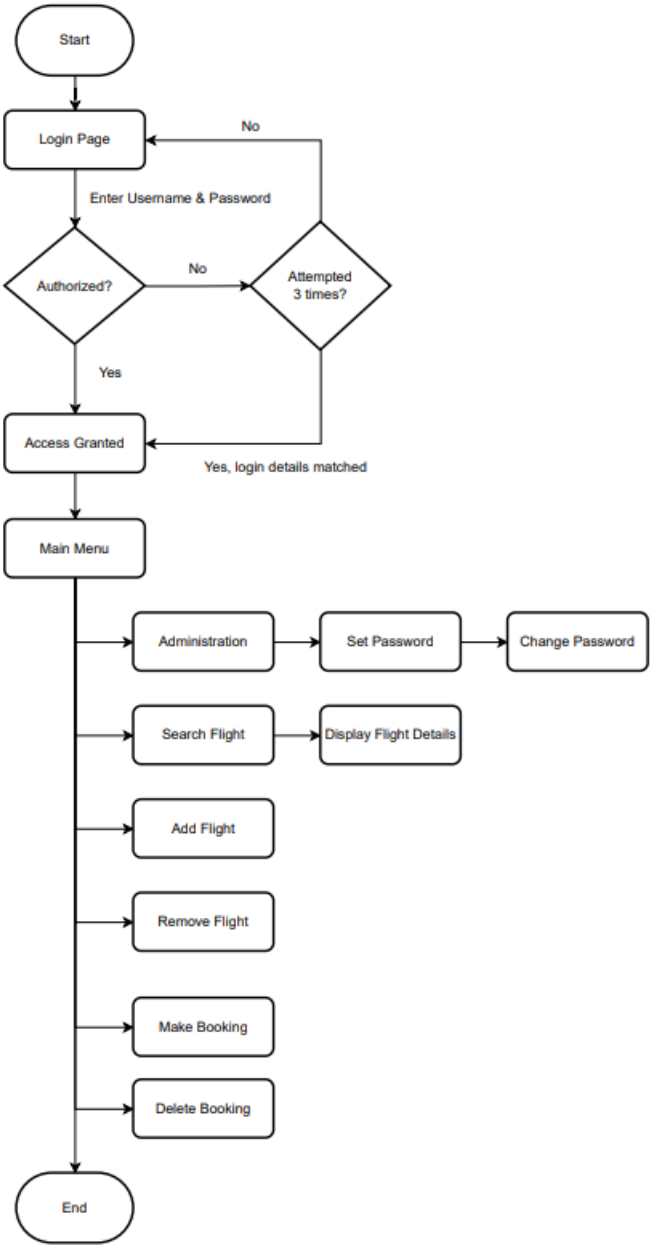
Access Granted:

This page signifies that the user has been successfully authenticated and authorized. It serves as a gateway to the Main Menu or other sections of the application.

Yes / No Attempted:

These options might be presented to users when authentication fails. "Yes" could indicate a retry, while "No" might lead to exiting the application or other appropriate actions.

Flowchart



View's implementation

Administrator View (Admin_View):

This view provides information relevant to administrators, such as passenger details and flight times for bookings. It selects data from the Booking, Passenger, and Flight tables.

```
-- Administrator view

CREATE VIEW Admin_View AS
```

```
SELECT
    Booking.Confirmation_ID,
    Passenger.Passenger_FName,
    Passenger.Passenger_LName,
    Flight.Org_Departure_Time,
    Flight.Des_Arrival_Time
FROM
    Booking
JOIN
    Passenger ON Booking.Passenger_ID = Passenger.Passenger_ID
JOIN
    Flight ON Booking.Confirmation_ID = Flight.Confirmation_ID;

select * from Admin_View;
```

Add Booking View (Add_Booking_View):

This view is likely used for adding bookings, providing information about the booking, passenger, flight, and associated costs. It selects data from the Booking, Passenger, Flight, and Cost tables.

```
-- Add Booking view
CREATE VIEW Add_Booking_View AS
SELECT
    Booking.Confirmation_ID,
    Passenger.Passenger_FName,
    Passenger.Passenger_LName,
    Flight.Org_Departure_Time AS Departure_Time,
    Flight.Des_Arrival_Time AS Arrival_Time,
    Cost.Amount AS Booking_Cost,
    Cost.Distance,
    Cost.Season_Of_Year,
    Cost.Day_Of_Week
```

```
FROM
    Booking
JOIN
    Passenger ON Booking.Passenger_ID = Passenger.Passenger_ID
JOIN
    Flight ON Booking.Confirmation_ID = Flight.Confirmation_ID
JOIN
    Cost ON Booking.Confirmation_ID = Cost.Cost_ID;
```

Delete Booking View (Delete_Booking_View):

This view is designed for deleting bookings and displays details about the booking, passenger, flight, and booking cost. It selects data from the Booking, Passenger, Flight, and Cost tables.

```
-- Delete Booking view
CREATE VIEW Delete_Booking_View AS
SELECT
    Booking.Confirmation_ID,
    Booking.Booking_Date,
    Booking.Booking_Platform,
    Booking.Booking_Type,
    Passenger.Passenger_ID,
    Passenger.Passenger_FName,
    Passenger.Passenger_LName,
    Flight.Flight_ID,
    Flight.Org_Departure_Time,
    Flight.Des_Arrival_Time,
    Cost.Amount AS Booking_Cost
FROM
    Booking
JOIN
    Passenger ON Booking.Passenger_ID = Passenger.Passenger_ID
```

```
JOIN
    Flight ON Booking.Confirmation_ID = Flight.Confirmation_ID
JOIN
    Cost ON Booking.Confirmation_ID = Cost.Cost_ID;
```

Add Flight View (Add_Flight_View):

This view offers information about flights, including details about the flight, pilot, plane, airports, and flight attendants. It selects data from the Flight table, as well as several other related tables via LEFT JOIN operations.

```
    -- Add Flight view
CREATE VIEW Add_Flight_View AS
SELECT
    Flight.Flight_ID,
    Flight.Org_Departure_Time,
    Flight.Des_Arrival_Time,
    Flight.Flight_Time,
    Pilot.Pilot_ID,
    Pilot.Pilot_FName,
    Pilot.Pilot_LName,
    Plane.Plane_ID,
    Plane.Plane_Model,
    Plane.Plane_Manufacturer,
    Org_Airport.Org_Airport_ID AS Org_Airport_ID,
    Org_Airport.Org_Airport_Loc AS Org_Airport_Location,
    Des_Airport.Des_Airport_ID AS Des_Airport_ID,
    Des_Airport.Des_Airport_Loc AS Des_Airport_Location,
    Flight_Attendent.Flight_Att_ID AS Flight_Attendant_ID,
    Flight_Attendent.Flight_Att_FName AS Flight_Attendant_FName,
    Flight_Attendent.Flight_Att_LName AS Flight_Attendant_LName
FROM
```

```
    Flight
LEFT JOIN
    Pilot ON Flight.Pilot_ID = Pilot.Pilot_ID
LEFT JOIN
    Plane ON Flight.Plane_ID = Plane.Plane_ID
LEFT JOIN
    Org_Airport ON Flight.Org_Airport_ID = Org_Airport.Org_Airport_ID
LEFT JOIN
    Des_Airport ON Flight.Des_Airport_ID = Des_Airport.Des_Airport_ID
LEFT JOIN
    Flight_Attendent ON Flight.Flight_Att_ID =
Flight_Attendent.Flight_Att_ID;
```

Remove Flight View (Remove_Flight_View):

This view is likely used to remove flights and provides information about flights, pilots, planes, and airport locations. It selects data from the Flight table, as well as other related tables via LEFT JOIN operations.

```
-- Remove Flight view
CREATE VIEW Remove_Flight_View AS
SELECT
    Flight.Flight_ID,
    Flight.Org_Departure_Time,
    Flight.Des_Arrival_Time,
    Pilot.Pilot_ID,
    Pilot.Pilot_FName,
    Pilot.Pilot_LName,
    Plane.Plane_ID,
    Plane.Plane_Model,
    Org_Airport.Org_Airport_ID AS Org_Airport_ID,
    Org_Airport.Org_Airport_Loc AS Org_Airport_Location,
    Des_Airport.Des_Airport_ID AS Des_Airport_ID,
```

```
    Des_Airport.Des_Airport_Loc AS Des_Airport_Location
FROM
    Flight
LEFT JOIN
    Pilot ON Flight.Pilot_ID = Pilot.Pilot_ID
LEFT JOIN
    Plane ON Flight.Plane_ID = Plane.Plane_ID
LEFT JOIN
    Org_Airport ON Flight.Org_Airport_ID = Org_Airport.Org_Airport_ID
LEFT JOIN
    Des_Airport ON Flight.Des_Airport_ID = Des_Airport.Des_Airport_ID;
```

Graphical User Interface Design

Connection to Database

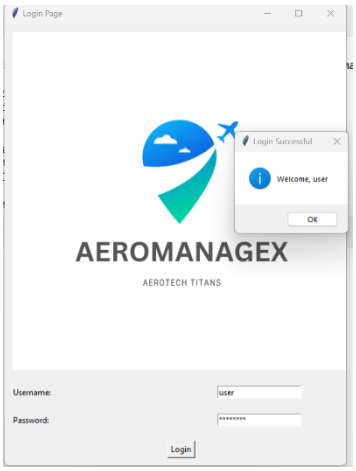
```
= RESTART: C:\Users\Bashir\OneDrive\1. Marist Co
st Semester\3. Database Mgt Sys\Project\Phase06\
ions\project_6.1_sql_connect.py
Database connection established successfully!
```

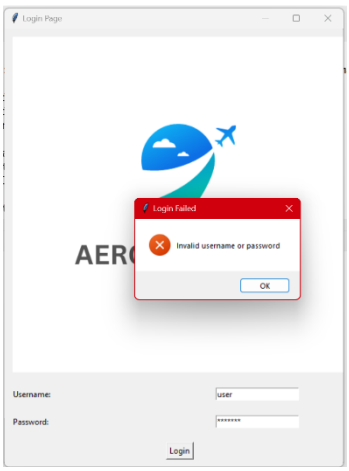
Login Page

Description:

The Login Page is the initial interface where users provide their cr edentials to access the application. It consists of input fields for username and password, along with a login button.

Visualization:





Implementation:

```
import tkinter as tk

from tkinter import messagebox


def check_credentials():

    username = entry_username.get()

    password = entry_password.get()

    # Replace the condition with database validation logic

    if username == "user" and password == "password":

        messagebox.showinfo("Login Successful", "Welcome,
{}".format(username))

        # If login successful, transition to Main Menu Page or perform
further actions

    else:

        messagebox.showerror("Login Failed", "Invalid username or
password")


# Create the main window for Login Page

root = tk.Tk()

root.title("Login Page")


# Widgets for Login Page
```

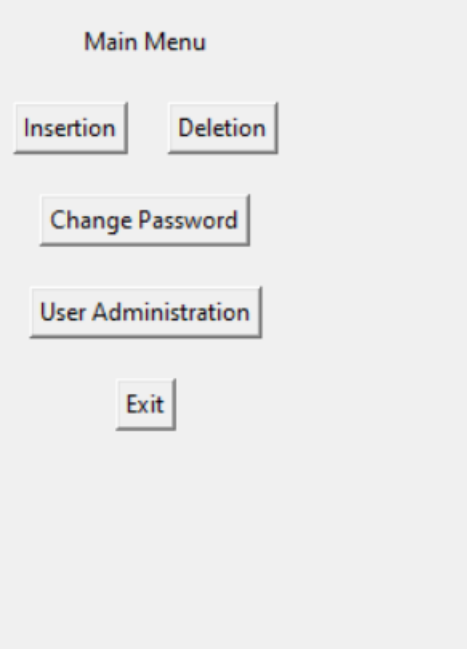
```
label_username = tk.Label(root, text="Username:")
label_username.grid(row=0, column=0, padx=10, pady=10)

entry_username = tk.Entry(root)
entry_username.grid(row=0, column=1, padx=10, pady=10)

label_password = tk.Label(root, text="Password:")
label_password.grid(row=1, column=0, padx=10, pady=10)

entry_password = tk.Entry(root, show="*")
entry_password.grid(row=1, column=1, padx=10, pady=10)

login_button = tk.Button(root, text="Login",
command=check_credentials)
login_button.grid(row=2, column=0, columnspan=2, pady=10)

# Run the main loop for Login Page
root.mainloop()
```

Main Menu Page

Description:

The Main Menu page allows users to find a variety of options. There are options like insertion, deletion, change password and user administration as well as exit. Users use this page to perform specific actions on the database.

Visualization:



Implementation:

```
# Function to display the main menu window
def show_main_menu_window():
    main_menu_window = tk.Tk()
    main_menu_window.title("Main Menu")

    # Make the window fullscreen
    main_menu_window.attributes("-fullscreen", True)

    def handle_menu_choice(choice):
        if choice == "0":
            main_menu_window.destroy()
        elif choice == "1":
            show_insertion_form_window()
        elif choice == "2":
            # Call the corresponding function for deletion
            pass
        elif choice == "6":
```

```
            show_change_password_window()
        elif choice == "7":
            show_user_administration_window()
```

Action Pages

Search Page

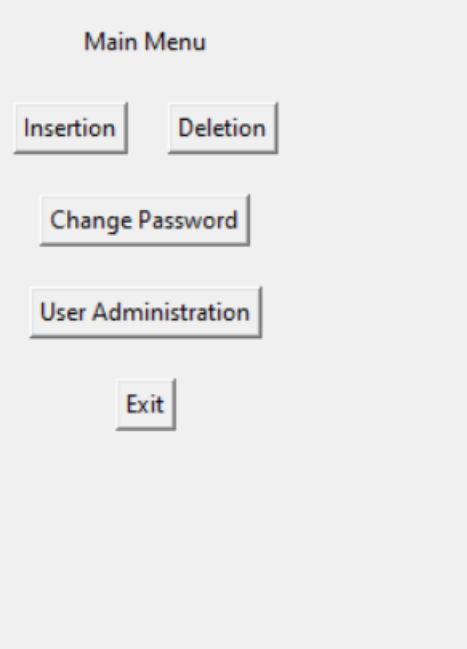
Administration

Search flight

Description:

The Search Page allows users to input search criteria and retrieve relevant information from the database. It typically includes input fields for search queries and a search button.

Visualization:



Implementation:

To be implemented …

Add flight

Remove flight

Make booking

Delete booking

13. References

1. Airline Suite. (n.d.). *Airline Suite Reviews - Pros & Cons, Ratings & More*. GetApp. https://www.getapp.com/operations-management-software/a/airline-suite/reviews/
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