

Airport Database Management System

Mini Project Report -Database Lab (DSE 2241)

Department of Data Science & Computer Applications



B. Tech Data Science

4th Semester – Batch: B1- Group: 3

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CERTIFICATE

This is to certify that Kshitij Sohoni(220968054), Akhil Ajai Kumar(220968062), Hemang Malik(220968092), M Dhanush Varma(220968082), Sreenivasa Sai Krishna Kartik(220968090), have successfully executed a mini project titled “Hotel Management System” rightly bringing fore the competencies and skill sets they have gained during the course- Database Lab (DSE 2241), thereby resulting in the culmination of this project.

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ABSTRACT

Methodology: The project employs SQL Plus as the primary tool for the database management system. It aims to integrate a user- friendly interface along with comprehensive, relational data to safeguard sensitive passenger information and implement data validation checks. This would enable users to access information regarding their flight and booking details such as flight number, ticket id, booking fare, flight schedule, arrival time, departure time etc

Results and Significance: Through implementation, the Airport-DBMS prioritizes simplicity for users and ensures secure, scalable interface for large-scale usage. It would enable improved efficiency for the airport and robust security for the user as well. It aims to foster better decision-making, resource allocation, and collaboration, leading to smoother airport operations.

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Chapter 1

Introduction

This project aims to develop an efficient airport database management system (ADBMS). It is designed to store and manage critical information related to airport operations such as data concerning flights, passengers, airport resources, and more all in real-time. This centralized database plays a crucial role in optimizing airport operations, streamlining processes, and enhancing the overall passenger experience.

Chapter 2

Synopsis

2.1 Proposed System

To create a proposed Airport Management System database, we will consider the main entities involved in airport operations such as flights, airlines, passengers, bookings, and airports.

2.2 Objectives

The Main Objective of the work are

Efficient Data Management: ADMS aims to efficiently store, organize, and manage vast amounts of data related to passengers, flights, cargo, employees, facilities, and security measures.

Streamlined Operations: The system seeks to streamline airport operations by automating processes, reducing manual tasks, and improving the overall efficiency of tasks such as flight scheduling, passenger check-in, fare of flights.

Enhanced Passenger Experience: ADMS aims to enhance the passenger experience by providing real-time flight information. The system mitigates the risk of inconvenience and data loss.

Optimized Resource Allocation: The system helps in optimizing resource allocation by providing insights flight schedules and facility utilization, thereby maximizing operational efficiency and minimizing costs.

Chapter 3

Functional Requirements

Data management: This includes functionalities for creating, storing, retrieving, updating, and deleting data within the database for airline scheduling, flight details, passenger details, ticket information etc

Data querying: Users should be able to query the database to retrieve specific information based on defined criteria especially regarding ticket fare, details and flight schedules.

This includes:

- Checking of ticket fare by passengers
- Retrieval of flight details like timings, gate etc
- Retrieval of schedules like destination, arrival time, departure time etc

Data manipulation: This involves functionalities for sorting, filtering, aggregating, and performing calculations on the stored data for creating reports.

This includes:

- Filtering data by airline
 - Sorting data by flight routes
- etc

User interaction: A user-friendly interface for users to interact with the database, such as a web interface or a command-line interface.

Chapter 4 Detailed Design

4.1 ER Diagram

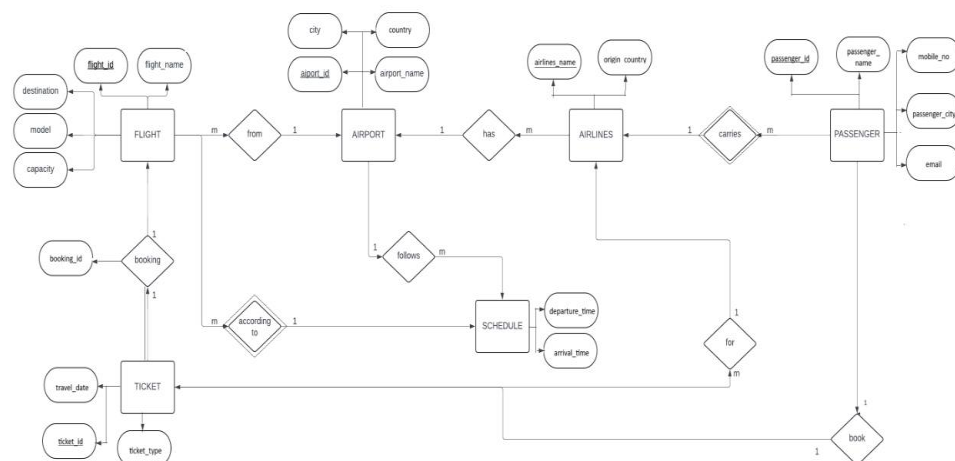


Figure 4.1 Entity Relationship Diagram

4.2 Schema Diagram

Airport(airport-id, airport_name, city, country)

flight(flight_id, flight_name, airlines_name, airport_id, destination, model, capacity)

airport_id References airport

Airlines(airlines_name, origin_country, airport_id)

airport-id References Airport

Passenger(passenger_id, passenger_name, mobile_no, passenger_city, email)

Ticket(ticket_id, ticket_type, travel_date, passenger_id)

passenger_id References Passenger

Booking(Booking_id,from,to,fare,ticket_id,flight_id)

ticket-id References ticket

flight_id References flight

Schedule(flight_id,airport_id,departure_time,arrival_time)

flight_id References flight, airport_id References airport

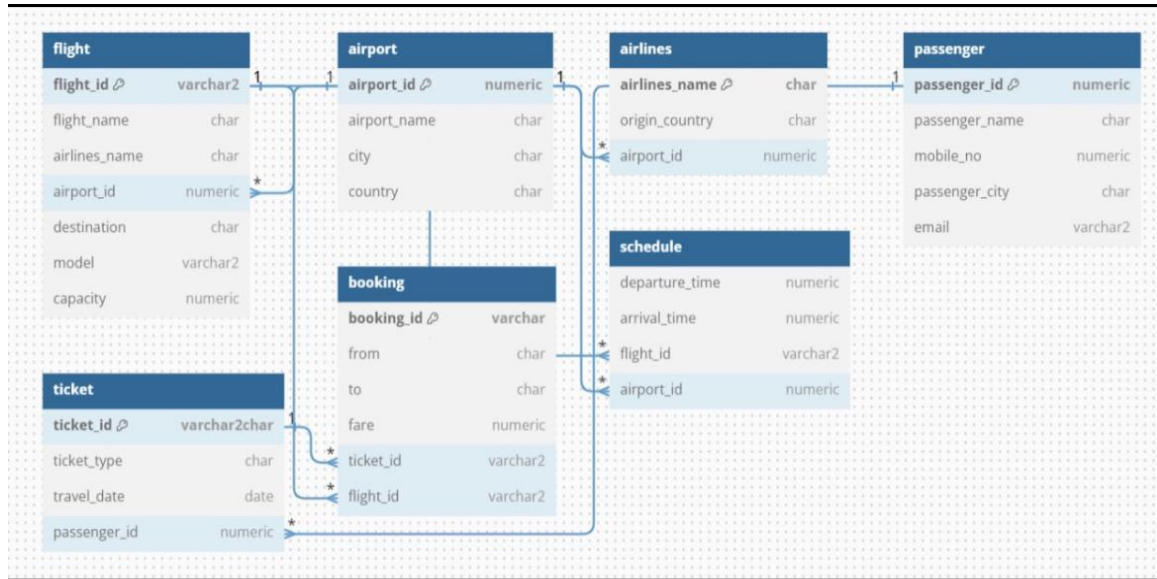


Figure 4.2 Schema Diagram

4.3 Data Dictionary

AIRPORT

Column	Data type (size)	Constraint	Constraint Name
Airport_Id	numeric(4)	Primary Key	airport_id_pk
Airport_Name	VARCHAR2(20)		
city	VARCHAR2(20)		
country	CHAR(1)		

FLIGHT

Column	Data type (size)	Constraint	Constraint Name
Flight_Id	Numeric(4)	Primary Key	flight_id_pk
Flight_Name	Varchar2(20)		
Airlines_Name	Varchar2(20)		
Airport_id	Number	Foreign Key	
destination	vvarchar(20)		
model	vvarchar(10)		
capacity	numeric(20)		

AIRLINES

Column	Data type (size)	Constraint	Constraint Name
Airlines_Name	vvarchar(50)	Primary Key	airlines_name_pk
origin_country	vvarchar(20)		
Airport_Id	Numeric(4)	Foreign Key	

PASSENGER

Column	Data type (size)	Constraint	Constraint Name
Passenger_Id	numeric(7)	Primary Key	p_id_pk
Passenger_name	Varchar2(20)		
Mobile_no	Numeric(10)		
Passenger_City	Varchar(10)		
email	vvarchar(20)		

TICKET

Column	Data type (size)	Constraint	Constraint Name
Ticket_id	Varchar(10)	Primary Key	Ticket_Id_PK
Ticket_Type	Varchar(5)		
Passenger_ID	Numeric(7)	Foreign Key	
Travel Date	Date		

BOOKING

Column	Data type (size)	Constraint	Constraint Name
Booking_id	Varchar(10)	Primary Key	booking_ID_PK
From	Varchar2(15)		
To	Varchar(15)		
Fare	Numeric(10)		
Ticket_id	Varchar(10)	Foreign Key	
Flight_id	numeric(4)	Foreign Key	

SCHEDULE

column	Data type(size)	Constraint	Constraint Name
Schedule_id	varchar(10)	Primary Key	schedule_id_pk
Departure_time	numeric(8)		
arrival_ttime	numeric(8)		
flight_id	numeric(4)	Foreign Key	
airport_id	numeric(4)	Foreign Key	

4.4 Relational Model Implementation

create table airport (

```
2  airport_id numeric(4) constraint airport_id_pk primary key,  
3  airport_name varchar(50),  
4  city varchar(20),  
5  country varchar(20)  
6 );
```

create table flight (

```
2  flight_id numeric(4) constraint flight_id_pk primary key,  
3  flight_name varchar(50),  
4  airlines_name varchar(20),  
5  airport_id numeric(4) references airport,  
6  destination varchar(20),  
7  model varchar(10),  
8  capacity numeric(20) check (capacity > 0)  
9 );
```

create table airlines(

```
2  airlines_name varchar(50) constraint airlines_name_pk primary key,  
3  origin_country varchar(20),  
4  airport_id numeric(4) references airport);
```

create table passenger (

```
2  passenger_id numeric(7) constraint p_id_pk primary key,
```

```
3  passenger_name varchar(20),
4  mobile_no numeric(10),
5  passenger_city varchar(10)
6 );
```

create table ticket (

```
2  ticket_id varchar(10) constraint ticket_id_pk primary key,
3  ticket_type varchar(5),
4  travel_date date,
5  passenger_id numeric(7) references passenger
6 );
```

create table booking (

```
2  booking_id varchar(10) constraint booking_id_pk primary key,
3  from_ varchar(15),
4  to_ varchar(15),
5  fare numeric(10) check (fare >= 0),
6  ticket_id varchar(10) references ticket,
7  flight_id numeric(4) references flight
8 );
```

create table schedule (

```
2  schedule_id varchar(10) constraint schedule_id_pk primary key,
3  departure_time numeric(8) check (departure_time >= 00000000 and departure_time <=
23595959),
4  arrival_time numeric(8) check (arrival_time >= 00000000 and arrival_time <=
23595959),
5  flight_id numeric(4) references flight,
```

```
6   airport_id numeric(4) references airport
7 );
```

4.4.1 Additional Constraints

```
SQL> alter table flight add constraint flight_id_length check (length(flight_id) = 4)
```

```
SQL> alter table flight add constraint airport_id_length check (length(airport_id) = 4);
```

```
SQL> alter table flight add constraint model_prefix check (model like 'airbus%' or model like
'boeing%');
```

```
SQL> alter table passenger add constraint passenger_id_length check (length(passenger_id) =
4);
```

```
SQL> alter table passenger add constraint mobile_no_length check (length(mobile_no) = 10);
```

```
SQL> alter table passenger add constraint email_suffix check (email like '%@gmail.com');
```

```
SQL> alter table ticket add constraint ticket_type_values check (ticket_type in ('economy',
'business', 'first class'));
```

```
SQL> alter table booking add constraint booking_id_length check (length(booking_id) = 6);
```

5. Implementation

5.1 Queries

Q Retrieve all flights departing from a specific airport:

```
SQL> SELECT f.flight_id, f.flight_name, f.destination, f.model, f.capacity
2  FROM flight f
3  WHERE f.airport_id = (SELECT airport_id FROM airport WHERE airport_name =
'Heathrow');
```

```
FLIGHT_ID FLIGHT_NAME
-----
```

DESTINATION	MODEL	CAPACITY
-------------	-------	----------

8901 SKY123		
London	Boeing 777	300

5678 SKY789		
London	Airbus A320	200

Q List all bookings made by a specific passenger:

```
SQL> SELECT b.booking_id, b.from_, b.to_, b.fare
2 FROM booking b
3 JOIN ticket t ON b.ticket_id = t.ticket_id
4 JOIN passenger p ON t.passenger_id = p.passenger_id
5 WHERE p.passenger_name = 'John Smith';
```

BOOKING_ID	FROM_	TO_	FARE
AB1234	JFK	Heathrow	5000

Q Find all flights operated by a specific airline:

```
SQL> SELECT f.flight_id, f.flight_name, f.destination, f.model, f.capacity
2 FROM flight f
3 JOIN airlines a ON f.airlines_name = a.airlines_name
4 WHERE a.airlines_name = 'Emirates';
```

FLIGHT_ID	FLIGHT_NAME
1234 AIR101	

DESTINATION	MODEL	CAPACITY
Dubai	Airbus A380	300

Q Retrieve the number of bookings for each flight:

```
SQL> SELECT f.flight_id, f.flight_name, COUNT(b.booking_id) AS num_bookings
2 FROM flight f
3 LEFT JOIN booking b ON f.flight_id = b.flight_id
4 GROUP BY f.flight_id, f.flight_name;
```

FLIGHT_ID	FLIGHT_NAME	NUM_BOOKINGS
1234 AIR101		1

7891 FLY123	3
5678 SKY789	2
3456 JET456	2
8765 WINGS202	2
8901 SKY123	0
2345 FLY321	0

Q Count the number of flights departing from each airport:

SQL> SELECT airport_id, COUNT(flight_id) AS num_flights FROM flight GROUP BY airport_id;

AIRPORT_ID NUM_FLIGHTS

```
-----
1234      2
7890      1
5678      2
9876      1
3456      1
```

Q List all bookings with their corresponding passengers and flights:

SQL> SELECT b.booking_id, b.from_, b.to_, b.fare, p.passenger_name, f.flight_name
2 FROM booking b
3 JOIN ticket t ON b.ticket_id = t.ticket_id
4 JOIN passenger p ON t.passenger_id = p.passenger_id
5 JOIN flight f ON b.flight_id = f.flight_id;

BOOKING_ID FROM_ TO_ FARE PASSENGER_NAME

FLIGHT_NAME

```
-----
GH4567 Dubai Intl Heathrow 7000 Maria Garcia
AIR101

AB1234 JFK Heathrow 5000 John Smith
FLY123

CD2345 Heathrow Narita 10000 Emily Johnson
SKY789
```

BOOKING_ID FROM_ TO_ FARE PASSENGER_NAME

 FLIGHT_NAME

EF3456 Narita JFK 8000 Satoshi Tanaka
 JET456

IJ5678 Tegel Narita 9000 Wei Chen
 WINGS202

KL6789 Narita JFK 12000 Ahmed Khan
 FLY123

BOOKING_ID FROM_ TO_ FARE PASSENGER_NAME

FLIGHT_NAME

MN7890 JFK Dubai Intl 15000 Sophie Dupont
 SKY789

ST0123 Tegel Narita 11000 Kim Ji-hyun
 JET456

UV1234 JFK Heathrow 5500 David Smith
 FLY123

Q Find the total revenue generated by each airline from ticket sales:

```
SQL> SELECT a.airlines_name, SUM(b.fare) AS total_revenue
2 FROM booking b
3 JOIN flight f ON b.flight_id = f.flight_id
4 JOIN airlines a ON f.airlines_name = a.airlines_name
5 GROUP BY a.airlines_name;
```

AIRLINES_NAME TOTAL_REVENUE

Japan Airlines	19000
British Airways	25000
Emirates	7000
Delta Airlines	22500
Lufthansa	18500

Q List all flights with their corresponding airlines and destinations:

```
SQL> SELECT f.*, a.airlines_name, a.origin_country
2 FROM flight f
3 JOIN airlines a ON f.airlines_name = a.airlines_name;
```

```
FLIGHT_ID FLIGHT_NAME
-----
AIRLINES_NAME   AIRPORT_ID DESTINATION   MODEL
-----
CAPACITY AIRLINES_NAME
-----
ORIGIN_COUNTRY
-----
      7891 FLY123
Delta Airlines      1234 New York      Boeing 737
      150 Delta Airlines
USA
```

```
FLIGHT_ID FLIGHT_NAME
-----
AIRLINES_NAME   AIRPORT_ID DESTINATION   MODEL
-----
CAPACITY AIRLINES_NAME
-----
ORIGIN_COUNTRY
-----
      3456 JET456
Japan Airlines      7890 Tokyo      Boeing 787
      180 Japan Airlines
Japan
```

```
FLIGHT_ID FLIGHT_NAME
-----
AIRLINES_NAME   AIRPORT_ID DESTINATION   MODEL
-----
CAPACITY AIRLINES_NAME
-----
ORIGIN_COUNTRY
-----
      8765 WINGS202
Lufthansa      3456 Berlin      Boeing 747
```

250 Lufthansa
Germany

FLIGHT_ID FLIGHT_NAME

AIRLINES_NAME AIRPORT_ID DESTINATION MODEL

CAPACITY AIRLINES_NAME

ORIGIN_COUNTRY

8901 SKY123
British Airways 5678 London Boeing 777
300 British Airways
UK

FLIGHT_ID FLIGHT_NAME

AIRLINES_NAME AIRPORT_ID DESTINATION MODEL

CAPACITY AIRLINES_NAME

ORIGIN_COUNTRY

5678 SKY789
British Airways 5678 London Airbus A320
200 British Airways
UK

FLIGHT_ID FLIGHT_NAME

AIRLINES_NAME AIRPORT_ID DESTINATION MODEL

CAPACITY AIRLINES_NAME

ORIGIN_COUNTRY

1234 AIR101
Emirates 9876 Dubai Airbus A380
300 Emirates
UAE

```

FLIGHT_ID FLIGHT_NAME
-----
AIRLINES_NAME   AIRPORT_ID DESTINATION   MODEL
-----
CAPACITY AIRLINES_NAME
-----
ORIGIN_COUNTRY
-----
2345 FLY321
Delta Airlines   1234 New York   Airbus A330
180 Delta Airlines
USA

```

Q Find the total number of bookings for each destination city:

```

SQL> SELECT f.destination, COUNT(b.booking_id) AS num_bookings
2  FROM booking b
3  JOIN flight f ON b.flight_id = f.flight_id
4  GROUP BY f.destination;

```

```

DESTINATION   NUM_BOOKINGS
-----
London        2
Tokyo         2
New York      3
Dubai         1
Berlin        2

```

5.2 Stored Procedures

Procedure to print all flights for a given airport:

```

create or replace procedure print_flights_from_airport(p_airport_name in varchar2) is
begin
  for rec in (select f.flight_id, f.flight_name, f.destination, f.model, f.capacity

```

```

        from flight f
        where f.airport_id = (select airport_id from airport where airport_name =
p_airport_name))
    loop
        dbms_output.put_line('flight id: ' || rec.flight_id || ', flight name: ' || rec.flight_name ||
        ', destination: ' || rec.destination || ', model: ' || rec.model ||
        ', capacity: ' || rec.capacity);
    end loop;
exception
    when no_data_found then
        dbms_output.put_line('no flights found for the airport ' || p_airport_name);
    when others then
        dbms_output.put_line('error: ' || sqlerrm);
end;

```

```

SQL> exec print_flights_from_airport('Heathrow');
Flight ID: 8901, Flight Name: SKY123, Destination: London, Model: Boeing 777,
Capacity: 300
Flight ID: 5678, Flight Name: SKY789, Destination: London, Model: Airbus A320,
Capacity: 200

PL/SQL procedure successfully completed.

```

Procedure to print all bookings for a given passenger:

create or replace procedure print_bookings_for_passenger(p_passenger_name in varchar2) is
begin

```

    for rec in (select b.booking_id, b.from_, b.to_, b.fare
        from booking b
        join ticket t on b.ticket_id = t.ticket_id
        join passenger p on t.passenger_id = p.passenger_id
        where p.passenger_name = p_passenger_name)
    loop
        dbms_output.put_line('booking id: ' || rec.booking_id || ', from: ' || rec.from_ ||
        ', to: ' || rec.to_ || ', fare: ' || rec.fare);
    end loop;
exception
    when no_data_found then
        dbms_output.put_line('no bookings found for passenger ' || p_passenger_name);
    when others then
        dbms_output.put_line('error: ' || sqlerrm);
end;

```

```
SQL> EXEC print_bookings_for_passenger('John Smith');
Booking ID: AB1234, From: JFK, To: Heathrow, Fare: 5000

PL/SQL procedure successfully completed.
```

5.3 Stored Functions

Calculate Total Fare for a Passenger:

```
create or replace function total_fare_for_passenger(p_passenger_id in numeric)
return numeric is
    v_total_fare numeric := 0;
begin
    select sum(b.fare) into v_total_fare
    from booking b
    join ticket t on b.ticket_id = t.ticket_id
    where t.passenger_id = p_passenger_id;

    return v_total_fare;
exception
    when no_data_found then
        return 0;
    when others then
        raise;
end;
```

/

```
SQL> SELECT total_fare_for_passenger(1111) FROM dual;

TOTAL_FARE_FOR_PASSENGER(1111)
-----
                        5000
```

Function to return total revenue of Specific airline:

create or replace function total_revenue_for_airline(p_airline_name in varchar2)

return number is

 v_total_revenue number := 0;

begin

 select sum(b.fare) into v_total_revenue

 from booking b

 join flight f on b.flight_id = f.flight_id

 join airlines a on f.airlines_name = a.airlines_name

 where a.airlines_name = p_airline_name;

 return v_total_revenue;

exception

 when no_data_found then

 return 0;

 when others then

 raise;

end;

/

```
SQL> SELECT total_revenue_for_airline('Emirates') FROM dual;

TOTAL_REVENUE_FOR_AIRLINE('EMIRATES')
-----
                                7000
```

5.4 Triggers

```
SQL> CREATE TABLE passenger_log (
 2   log_id NUMBER GENERATED BY DEFAULT ON NULL AS IDENTITY,
 3   log_message VARCHAR2(255),
 4   log_date TIMESTAMP DEFAULT CURRENT_TIMESTAMP
 5 );

Table created.

SQL>
SQL> CREATE OR REPLACE TRIGGER log_passenger_insert_trigger
 2 AFTER INSERT ON passenger
 3 FOR EACH ROW
 4 BEGIN
 5     INSERT INTO passenger_log (log_message)
 6     VALUES ('New passenger added: ' || :NEW.passenger_name || ', ID: ' || :NEW.passenger_id);
 7 END;
 8 /

Trigger created.

SQL> INSERT INTO Passenger (passenger_id, passenger_name, mobile_no, passenger_city) VALUES ('9123', 'Alex Hunter', '444
5556666', 'Delhi');

1 row created.
```

```
SQL> select * from passenger_log;

LOG_ID
-----
LOG_MESSAGE
-----
LOG_DATE
-----
1
New passenger added: Alex Hunter, ID: 9123
03-APR-24 10.43.10.331000 AM
```

6. Result

BOOKING_ID	FROM_	TO_	FARE	PASSENGER_NAME
FLIGHT_NAME				
MN7890	JFK	Dubai Intl	15000	Sophie Dupont
SKY789				
ST0123	Tegel	Narita	11000	Kim Ji-hyun
JET456				
UV1234	JFK	Heathrow	5500	David Smith
FLY123				

FLIGHT_ID	FLIGHT_NAME	NUM_BOOKINGS
1234	AIR101	1
7891	FLY123	3
5678	SKY789	2
3456	JET456	2
8765	WINGS202	2
8901	SKY123	0
2345	FLY321	0

AIRLINES_NAME		TOTAL_REVENUE	

Japan Airlines		19000	
British Airways		25000	
Emirates		7000	
Delta Airlines		22500	
Lufthansa		18500	

FLIGHT_ID FLIGHT_NAME			

AIRLINES_NAME	AIRPORT_ID	DESTINATION	MODEL

CAPACITY		AIRLINES_NAME	
-----		-----	
ORIGIN_COUNTRY			

5678 SKY789			
British Airways	5678	London	Airbus A320
200 British Airways			
UK			

AIRLINES_NAME		TOTAL_REVENUE	

Japan Airlines		19000	
British Airways		25000	
Emirates		7000	
Delta Airlines		22500	
Lufthansa		18500	

FLIGHT_ID FLIGHT_NAME			

AIRLINES_NAME	AIRPORT_ID	DESTINATION	MODEL

CAPACITY		AIRLINES_NAME	
-----		-----	
ORIGIN_COUNTRY			

5678 SKY789			
British Airways	5678	London	Airbus A320
200 British Airways			
UK			

7. Conclusion and Future Work

7.1 Conclusion

In conclusion, the implementation of customer details integrated within the airport database management system, complemented by the ease of accessing information through multiple primary keys, establishes a robust system for efficient airport operations and passenger service. By ensuring data consistency and providing identifiers such as Passenger ID, the system mitigates the risk of inconvenience and data loss. The system can identify common user queries such as flight schedule, details, fares etc which not only enhances passenger convenience but also maximizes revenue potential and operational efficiency for airports.

7.2 Scope for future work

The system has scope for expansion by leveraging insights from passenger behaviour and trends can provide additional enhancements in our airport database management system. By identifying trends such as peak travel seasons and popular routes, we can optimize resources and services to meet passenger demand effectively. For example, we can allocate additional staff and security measures during peak periods to ensure smooth operations and enhance passenger satisfaction. Furthermore, implementing dynamic pricing strategies for airline tickets and airport services during high-demand periods can maximize revenue generation.

Each Team Member Contribution:

Team Member	Contribution
Hemang Malik	Inserted data in tables, formatted the report and wrote PL/SQL functions.
Kshitij Sohoni	Created tables and Data Dictionary
M Dhanush Varma	Intro, Report and Conclusion
Akhil Ajai Kumar	Wrote Functional Requirements
Sreenivasa Sai Krishna Kartik	Established Relationships and ER Diagram