AIRLINE MANAGEMENT SYSTEM

Database Management System

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INTRODUCTION

The airline management system project aims to streamline airline operations by integrating reservation, scheduling, ticketing, and fleet management processes into a unified platform. In this project, we aim to develop an Airline Management System using SQL and PL/SQL. Key features include passenger booking, seat allocation, flight scheduling, crew management, aircraft maintenance and real-time updates for flight status. The system enhances efficiency, improves customer experience, and ensures optimal resource utilization for airlines.

The airline industry is a complex ecosystem requiring efficient management of various resources and operations to ensure smooth and safe travel for passengers. To streamline these operations and enhance overall efficiency, airline companies often leverage Database Management Systems to organize and manage their data effectively.

An airline management project involves the creation of a comprehensive database that stores and manages critical information related to flights, aircraft, passengers, crew members, reservations, schedules, and more. By centralizing this data, airline companies can optimize their operations, improve customer service, and make data-driven decisions to enhance overall performance.

In this project, we aim to develop an Airline Management System using SQL and PL/SQL. Key features include passenger booking, seat allocation, flight scheduling, crew management, aircraft maintenance and real-time updates for flight status.

By understanding the intricacies of airline management within a DBMS context, we can appreciate how technology plays a pivotal role in transforming the airline industry, making air travel safer, more efficient, and more convenient for passengers worldwide.

REQUIREMENT ANALYSIS

To develop a successful Airline Management System, we need to analyze the requirements of the system. The following are the primary requirements for the system:

- Maintenance of Aircrafts: In the airline management system project, aircraft maintenance functionality is essential for ensuring the safety and reliability of the fleet. It involves inspections, repairs, and component replacements. The system facilitates efficient maintenance planning, monitors aircraft health data, and generates maintenance reports to optimize aircraft availability and minimize downtime.

- Summary of Flights: The flights project aims to optimize the management of airline routes and schedules. It involves creating and managing flight itineraries, including departure and arrival times, aircraft assignments, and seat availability. The system also tracks real-time flight status, handles reservations, and facilitates check-in processes.

- Data Management: Data management in the project includes handling passenger data, flight schedules, crew information, maintenance records, and other relevant data sets. The system ensures data integrity, security, and accessibility, enabling seamless communication between different modules and stakeholders.

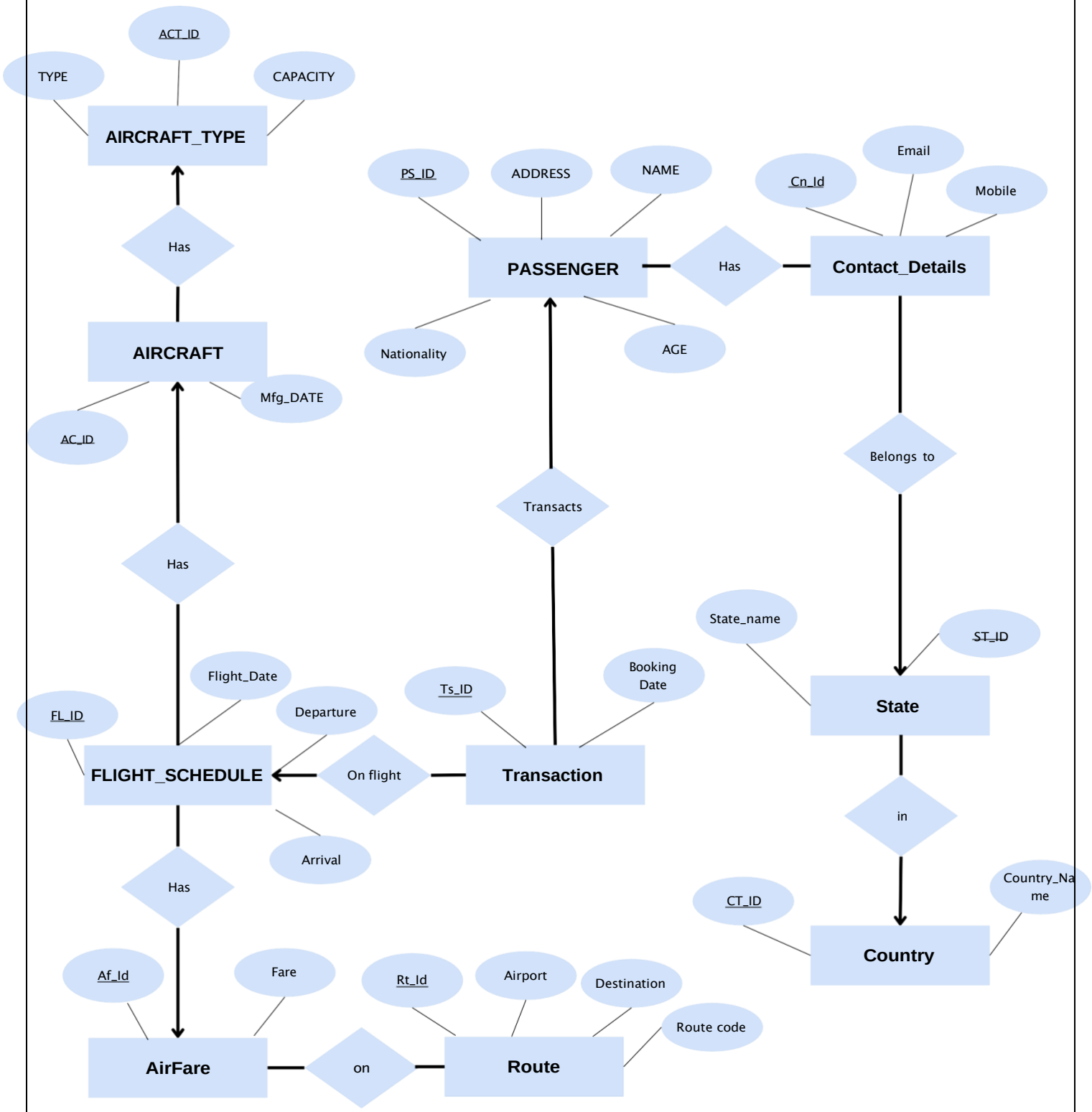
- Ticket Management: Ticket management in the project involves handling the entire ticketing process from booking to boarding. It includes functionalities such as ticket reservations, seat assignments, fare calculation, payment processing, and ticket issuance.

- Flight Details: Flight details refer to essential information about a specific flight within the airline management system. This includes the flight number, departure and arrival times, origin and destination airports, seating configuration, and current status. By providing concise details, the system enables efficient flight planning, passenger communication, and operational coordination for the airline.

SOFTWARE REQUIREMENTS

1. SQL
2. PL/SQL
3. Command Prompt

ER DIAGRAM


ACT_ID
TYPE
CAPACITY
AIRCRAFT_TYPE
Has
AIRCRAFT
Mfg_DATE
AC_ID
Has
Flight_Date
FL_ID
Departure
FLIGHT_SCHEDULE
Arrival
Has
Af_Id
Fare
AirFare
PS_ID
ADDRESS
NAME
PASSENGER
Nationality
AGE
Transacts
Ts_ID
Booking Date
Transaction
On flight
Rt_Id
Airport
Destination
Route code
Route
on
Has
Cn_Id
Email
Mobile
Contact_Details
Belongs to
State_name
ST_ID
State
in
CT_ID
Country_Name
Country

ER TO TABLE

1. Relation ‘Transacts’

Passenger:-ps_id, address, name,age, nationality

Transaction:-ts_id, booking_date, ps_id(FK)

2. Relation ‘Belongs to’

State:-st_id, State_name

Contact_Details:-Cn_id, Email, Mobile, st_id(FK)

3. Relation ‘Has’

Passenger:-ps_id, address, name,age, nationality

Contact_Details:-Cn_id, Email, Mobile

Has:-st_id, Cn_id;

4. Relation ‘in’

Country:-ct_id, Country_name

State:-st_id,State_name, ct_id(FK)

5. Relation ‘on’

AirFare:-Af_id, Fare

Route:-Rt_id, Airport, Destination, Route_code

On:-Af_id, Rt_id

6. Relation ‘Has’

AirFare:-Af_id, Fare

Flight_Schedule:-Fl_id, Flight_Date, Departure, Arrival, Af_id(FK)

7. Relation ‘Has’

Aircraft:-Ac_id, Mfg_date

Flight_Schedule:-Fl_id, Flight_Date, Departure, Arrival, Ac_id(FK)

8. Relation ‘Has’

Aircraft_Type:-Act_id, Type, Capacity

Aircraft:-Ac_id, Mfg_date, Act_id(FK)

9. Relation ‘On flights’

Flight_Schedule:-Fl_id, Flight_Date, Departure, Arrival

Transaction:-ts_id, booking_date, Fl_id(FK)

NORMALIZATION

Tables with functional dependencies

Country [BCNF]

Primary Key: CUD

CtID ->CountryName

CREATE TABLE ‘Country’

{

‘CtID’ INT NOT NULL AUTO_INCREMENT,

‘Country_name’ varchar(32) NOT NULL,

};

State [BCNF]

Primary Key: StID

StID->StateName | Country

CREATE TABLE ‘State’

{

‘StID’ INT NOT NULL AUTO_INCREMENT UNIQUE,

‘StateName’ varchar(32) NOT NULL,

‘Country’INT NOT NULL,

PRIMARY KEY (‘StID’),

FOREIGN KEY (‘Country’) REFERENCES ‘Country’ (‘CtID’)

};

Contact_Details [BCNF]

Primary Key: CnID

CnID-> Email | Mobile | State

CREATE TABLE ‘Contact_Details’

{

‘CnID’ INT NOT NULL AUTO_INCREMENT,

‘Email’varchar(50) NOT NULL,

‘Mobile’varchar(16) NOT NULL,

‘State’ INT NOT NULL,

PRIMARY KEY (‘CnID’),

FOREIGN KEY (‘State’) REFERENCES ‘State’ (‘StID’)

};

CREATE TABLE ‘Flight_Schedule’

{

‘FlID’ INT NOT NULL AUTO_INCREMENT,

‘FlightDate’ DATE NOT NULL,

‘Departure’ DATETIME NOT NULL,

‘Arrival’ DATETIME NOT NULL,

‘Aircraft’ INT NOT NULL,

‘NetFare’ INT NOT NULL,

PRIMARY KEY (‘FlID’),

FOREIGN KEY (‘Aircraft’) REFERENCES ‘Aircraft’ (‘AcID’)

FOREIGN KEY (‘Aircraft’) REFERENCES ‘Aircraft’ (‘AcID’)

};

AirFare [BCNF]

Primary key: AfID

AfID -> Route | Fare

CREATE TABLE ‘Airfare’

{

‘AfID’ INT NOT NULL AUTO_INCREMENT,

‘Route’INT NOT NULL,

‘Fare’ INT NOT NULL,

‘NetFare’ INT NOT NULL,

PRIMARY KEY (‘AfID’),

FOREIGN KEY (‘Route’) REFERENCES ‘Route’ (‘RtID’)

};

Route [BCNF]

Primary Key: RtID

RtID-> Airport | Destination | RouteCode

CREATE TABLE ‘Route’

{

‘RtID’ INT NOT NULL AUTO_INCREMENT,

‘Airport’varchar(32) NOT NULL,

‘Destination’varchar(32) NOT NULL,

‘RouteCode’varchar(16) NOT NULL UNIQUE,

PRIMARY KEY (‘RtID’)

};

AirCraft [2NF]

Primary Key: AcID

AcID->Ac_Type | Capacity | Mfg_Date

Ac_Type-> Capacity

AirCraft [BCNF]

Primary Key: AcID

AcID->Ac_Type | Ac_Type | Mfg_Date

CREATE TABLE ‘AirCraft’

{

‘AcID’ INT NOT NULL AUTO_INCREMENT,

‘Air_Type’ INT NOT NULL,

‘Mfg_Date’DATE NOT NULL,

PRIMARY KEY (‘AcID’)

FOREIGN KEY (‘Ac_Type’) REFERENCES ‘AirCraft_Type’ (‘AcID’)

};

AirCraft_Type [BCNF] (fron decomposition)

Primary Key: ActID

ActID-> Type | Capacity

CREATE TABLE ‘AirCraft_Type’

{

‘ActID’ INT NOT NULL AUTO_INCREMENT,

‘Type’ varchar(32) NOT NULL,

‘Capacity’ INT NOT NULL,

PRIMARY KEY (‘ActID’)

};

Passenger [BCNF]

Primary Key: PsID

PsID-> Name | Address | Age | Nationality | Contacts

CREATE TABLE ‘Contact_Details’

{

‘PsID’ INT NOT NULL AUTO_INCREMENT,

‘Name’ varchar(32) NOT NULL,

‘Address’ varchar(64) NOT NULL,

‘Age’ INT NOT NULL,

‘Nationality’varchar(16) NOT NULL,

‘Contacts’ INT NOT NULL,

PRIMARY KEY (‘PsID’),

FOREIGN KEY (‘Contacts’) REFERENCES ‘Contact_Detail’ (‘CnID’)

};

Transaction [BCNF]

Primary Key: TsID

TsID->BookingDate | Passenger | Flight

CREATE TABLE ‘Transaction’

{

‘TsID’ INT NOT NULL AUTO_INCREMENT,

‘BookingDate’ DATETIME NOT NULL,

‘Passenger’ INT NOT NULL,

‘Flight’ INT NOT NULL,

PRIMARY KEY (‘TsID’),

FOREIGN KEY (‘Passenger’) REFERENCES ‘Passenger’ (‘PsID’),

FOREIGN KEY (‘Flight’) REFERENCES ‘Flight_Schedule’ (‘FlID’)

};

Flight_Schedule [2NF]

Primary Key: FlID

FlID->FlightDate | Departure | Arrival | AirCraft | NetFare

Departure->FlightDate

SQL

Creation of Tables:-

Table 1: Country

```
  1  create table country(
  2  ct_id int primary key,
  3  country_name varchar2(32) not null
  4* )
SQL> /

Table created.
```

```
SQL> desc country;
 Name                                      Null?    Type
 ----------------------------------------- -------- ----------------------------
 CT_ID                                     NOT NULL NUMBER(38)
 COUNTRY_NAME                              NOT NULL VARCHAR2(32)
```

Table 2: State

```
SQL> create table state(
  2  st_id int primary key,
  3  state_name varchar2(32) not null,
  4  country int not null,
  5  foreign key(country) references country(ct_id));

Table created.
```

```
SQL> desc state;
 Name                                      Null?    Type
 ----------------------------------------- -------- ----------------------------
 ST_ID                                     NOT NULL NUMBER(38)
 STATE_NAME                                NOT NULL VARCHAR2(32)
 COUNTRY                                   NOT NULL NUMBER(38)
```

Table 3: Contact_Details

```
SQL> create table contact_details(
  2  cn_id int primary key,
  3  email varchar2(50) not null,
  4  mobile varchar2(16) not null,
  5  state int not null,
  6  foreign key(state) references state(st_id));

Table created.
```

```
SQL> desc contact_details;
 Name                                      Null?    Type
 ----------------------------------------- -------- ----------------------------
 CN_ID                                     NOT NULL NUMBER(38)
 EMAIL                                     NOT NULL VARCHAR2(50)
 MOBILE                                    NOT NULL VARCHAR2(16)
 STATE                                     NOT NULL NUMBER(38)
```

Table 4: Passenger

```
SQL> create table passenger(
  2  ps_id int primary key,
  3  name varchar2(32) not null,
  4  address varchar2(64) not null,
  5  age int not null,
  6  nationality varchar2(16) not null,
  7  contacts int not null,
  8  foreign key(contacts) references contact_details(cn_id));

Table created.
```

```
SQL> desc passenger;
 Name                                      Null?    Type
 ----------------------------------------- -------- ----------------------------
 PS_ID                                     NOT NULL NUMBER(38)
 NAME                                      NOT NULL VARCHAR2(32)
 ADDRESS                                   NOT NULL VARCHAR2(64)
 AGE                                       NOT NULL NUMBER(38)
 NATIONALITY                               NOT NULL VARCHAR2(16)
 CONTACTS                                  NOT NULL NUMBER(38)

SQL>
```

Table 5: Aircraft_Type

```
  1  create table aircraft_type(
  2  act_id int primary key,
  3  type varchar2(32) not null,
  4  capacity int not null
  5* )
SQL>
SQL> /

Table created.
```

```
SQL> desc aircraft_type;
 Name                                      Null?    Type
 ----------------------------------------- -------- ----------------------------
 ACT_ID                                    NOT NULL NUMBER(38)
 TYPE                                      NOT NULL VARCHAR2(32)
 CAPACITY                                  NOT NULL NUMBER(38)
```

Table 6: Aircraft

```
  1  create table aircraft(
  2  acid int primary key,
  3  ac_type int not null,
  4  mfg_date date not null,
  5* foreign key(ac_type) references aircraft_type(act_id))
SQL> /

Table created.
```

```
SQL> desc aircraft;
 Name                                      Null?    Type
 ----------------------------------------- -------- ----------------------------
 ACID                                      NOT NULL NUMBER(38)
 AC_TYPE                                   NOT NULL NUMBER(38)
 MFG_DATE                                  NOT NULL DATE
```

Table 7: Airfare

```
SQL> create table airfare(
  2  af_id int primary key,
  3  route int not null,
  4  fare int not null,
  5  foreign key(route) references route(rt_id));

Table created.
```

```
SQL> desc airfare;
 Name                                      Null?    Type
 ----------------------------------------- -------- ----------------------------
 AF_ID                                     NOT NULL NUMBER(38)
 ROUTE                                     NOT NULL NUMBER(38)
 FARE                                      NOT NULL NUMBER(38)
```

Table 8: Flight_Schedule

```
SQL> create table flight_schedule(
  2  fl_id int primary key,
  3  flight_date date not null,
  4  departure timestamp not null,
  5  arrival timestamp not null,
  6  aircraft int not null,
  7  netfare int not null,
  8  foreign key(aircraft) references aircraft(acid),
  9  foreign key(netfare) references airfare(af_id));

Table created.
```

```
SQL> desc flight_schedule;
 Name                                      Null?    Type
 ----------------------------------------- -------- ----------------------------
 FL_ID                                     NOT NULL NUMBER(38)
 FLIGHT_DATE                               NOT NULL DATE
 DEPARTURE                                 NOT NULL TIMESTAMP(6)
 ARRIVAL                                   NOT NULL TIMESTAMP(6)
 AIRCRAFT                                  NOT NULL NUMBER(38)
 NETFARE                                   NOT NULL NUMBER(38)
```

Table 9: Transaction

```
  1  create table transaction(
  2  ts_id int primary key,
  3  booking_date timestamp not null,
  4  passenger int not null,
  5  flight int not null,
  6  foreign key(passenger) references passenger(ps_id),
  7  foreign key(flight) references flight_schedule(fl_id)
  8* )
SQL> /

Table created.
```

```
SQL> desc transaction;
 Name                                      Null?    Type
 ----------------------------------------- -------- ----------------------------
 TS_ID                                     NOT NULL NUMBER(38)
 BOOKING_DATE                              NOT NULL TIMESTAMP(6)
 PASSENGER                                 NOT NULL NUMBER(38)
 FLIGHT                                    NOT NULL NUMBER(38)
```

Table 10: Route

```
SQL> create table route(
  2  rt_id int primary key,
  3  airport varchar2(32) not null,
  4  destination varchar2(32) not null,
  5  routecode varchar2(16) not null unique);

Table created.
```

Inserting values into Tables:-

```
SQL> select * from passenger;

     PS_ID NAME
---------- --------------------------------
ADDRESS                                                                 AGE
---------------------------------------------------------------------- ----------
NATIONALITY        CONTACTS
---------------- ----------
         1 John Doe
123 Main Street                                                          30
USA                      1

         2 Jane Smith
456 Elm Street                                                           25
Canada                   2

     PS_ID NAME
---------- --------------------------------
ADDRESS                                                                 AGE
---------------------------------------------------------------------- ----------
NATIONALITY        CONTACTS
---------------- ----------

         3 Ali Khan
789 Oak Avenue                                                           28
Pakistan                 3

         4 Rachel Lee
321 Pine Road                                                            35

     PS_ID NAME
---------- --------------------------------
ADDRESS                                                                 AGE
---------------------------------------------------------------------- ----------
NATIONALITY        CONTACTS
---------------- ----------
Singapore                4

         5 Neha Sharma
567 Maple Lane                                                           29
India                    5

         6 Tashi Wangmo

     PS_ID NAME
---------- --------------------------------
```

```
---------- --------------------------------
ADDRESS                                                                 AGE
---------------------------------------------------------------------- ----------
NATIONALITY        CONTACTS
---------------- ----------
890 Cedar Court                                                          32
Bhutan                   6

         7 Adam Abdul
234 Birch Street                                                         27
Maldives                 7


     PS_ID NAME
---------- --------------------------------
ADDRESS                                                                 AGE
---------------------------------------------------------------------- ----------
NATIONALITY        CONTACTS
---------------- ----------
         8 May Lin
678 Pine Lane                                                            31
Malaysia                 8

         9 David Nguyen
901 Oak Road                                                             26
Vietnam                  9

     PS_ID NAME
---------- --------------------------------
ADDRESS                                                                 AGE
---------------------------------------------------------------------- ----------
NATIONALITY        CONTACTS
---------------- ----------

        10 Lisa Santos
345 Cedar Avenue                                                         33
Philippines             10

        11 Ahmad Khan
567 Pine Avenue                                                          34

     PS_ID NAME
---------- --------------------------------
```

```
---------- ------------------------------------
ADDRESS                                                                  AGE
-------------------------------------------------------------------------- ----------
NATIONALITY        CONTACTS
---------------- ----------
Afghanistan              11

        12 Emily Wong
890 Oak Lane                                                              27
Malaysia                 12

        13 Michael Johnson

     PS_ID NAME
---------- ------------------------------------
ADDRESS                                                                  AGE
-------------------------------------------------------------------------- ----------
NATIONALITY        CONTACTS
---------------- ----------
123 Elm Road                                                              29
USA                      13

        14 Priya Patel
456 Birch Street                                                          26
India                    14


     PS_ID NAME
---------- ------------------------------------
ADDRESS                                                                  AGE
-------------------------------------------------------------------------- ----------
NATIONALITY        CONTACTS
---------------- ----------
        15 Carlos Rodriguez
789 Maple Avenue                                                          32
Mexico                   15

        16 Sophia Adams
321 Oak Lane                                                              31
Canada                   16

     PS_ID NAME
---------- ------------------------------------
ADDRESS                                                                  AGE
-------------------------------------------------------------------------- ----------
NATIONALITY        CONTACTS
---------------- ----------

        17 James Smith
567 Pine Street                                                           28
USA                      17

        18 Amit Patel
890 Cedar Avenue                                                          30

     PS_ID NAME
---------- ------------------------------------
ADDRESS                                                                  AGE
-------------------------------------------------------------------------- ----------
NATIONALITY        CONTACTS
---------------- ----------
India                    18

        19 Maria Garcia
234 Elm Road                                                              27
Mexico                   19

        20 Mohammed Khan

     PS_ID NAME
---------- ------------------------------------
ADDRESS                                                                  AGE
-------------------------------------------------------------------------- ----------
NATIONALITY        CONTACTS
---------------- ----------
678 Maple Street                                                          29
Pakistan                 20


20 rows selected.
```

```
SQL> select * from route;

     RT_ID AIRPORT                         DESTINATION
---------- ------------------------------ ------------------------------
ROUTECODE
---------------
         1 Pakistan                       India
PK-IN

         2 Bangladesh                     India
BD-IN

         3 Sri Lanka                      India
LK-IN

     RT_ID AIRPORT                         DESTINATION
---------- ------------------------------ ------------------------------
ROUTECODE
---------------
         4 Nepal                          India
NP-IN

         5 Bhutan                         India
BT-IN

         6 Maldives                       India
MV-IN

     RT_ID AIRPORT                         DESTINATION
---------- ------------------------------ ------------------------------
ROUTECODE
---------------
         7 Afghanistan                    India
AF-IN

         8 Myanmar                        India
MM-IN

         9 Malaysia                       India
MY-IN

     RT_ID AIRPORT                         DESTINATION
---------- ------------------------------ ------------------------------
ROUTECODE
---------------
        10 Singapore                      India
SG-IN

        11 Thailand                       India
TH-IN

        12 Indonesia                      India
ID-IN

     RT_ID AIRPORT                         DESTINATION
---------- ------------------------------ ------------------------------
ROUTECODE
---------------
        13 Philippines                    India
PH-IN

        14 Cambodia                       India
KH-IN

14 rows selected.
```

```
SQL> select * from aircraft_type;

    ACT_ID TYPE                                 CAPACITY
---------- ---------------------------------- ----------
         1 Boeing 737                                150
         2 Airbus A320                               180
         3 Boeing 777                                300
         4 Airbus A350                               280
         5 Embraer E190                              100
         6 Bombardier CRJ900                          90
         7 ATR 72                                     70
         8 Cessna 172                                  4
         9 Gulfstream G650                            14
        10 Global 7500                                19
        11 Boeing 747                                400

    ACT_ID TYPE                                 CAPACITY
---------- ---------------------------------- ----------
        12 Airbus A380                                550
        13 Embraer E175                                80
        14 Bombardier Q400                             90
        15 Cessna Citation X                            8

15 rows selected.
```

```
SQL> select * from aircraft;

        ACID     AC_TYPE MFG_DATE
---------- ---------- ---------
         1          1 01-JAN-22
         2          2 15-MAY-20
         3          3 30-NOV-19
         4          1 20-AUG-21
         5          4 10-APR-18
         6          5 05-DEC-20
         7          1 02-SEP-17
         8          6 15-MAR-16
         9          7 25-JUL-15
        10          1 18-FEB-19
        11          8 30-JUN-18

        ACID     AC_TYPE MFG_DATE
---------- ---------- ---------
        12          9 12-NOV-17
        13          1 04-SEP-16
        14         10 22-OCT-20
        15         11 01-APR-19

15 rows selected.
```

```
SQL> select * from airfare;

      AF_ID      ROUTE       FARE
---------- ---------- ----------
         1          1        200
         2          2        150
         3          3        180
         4          4        120
         5          5        140
         6          6        250
         7          7        300
         8          8        180
         9          9        280
        10         10        350
        11         11        400

      AF_ID      ROUTE       FARE
---------- ---------- ----------
        12         12        320
        13         13        280
        14         14        380

14 rows selected.
```

```
SQL> select * from flight_schedule;

     FL_ID FLIGHT_DA
---------- ---------
DEPARTURE
---------------------------------------------------------------------------
ARRIVAL
---------------------------------------------------------------------------
  AIRCRAFT    NETFARE
---------- ----------
         1 15-MAY-24
01-MAY-24 08.00.00.000000 AM
01-MAY-24 10.30.00.000000 AM
         1          1


     FL_ID FLIGHT_DA
---------- ---------
DEPARTURE
---------------------------------------------------------------------------
ARRIVAL
---------------------------------------------------------------------------
  AIRCRAFT    NETFARE
---------- ----------
         2 16-MAY-24
01-MAY-24 12.00.00.000000 PM
01-MAY-24 02.30.00.000000 PM
         2          2


     FL_ID FLIGHT_DA
---------- ---------
DEPARTURE
---------------------------------------------------------------------------
ARRIVAL
---------------------------------------------------------------------------
  AIRCRAFT    NETFARE
---------- ----------
         3 17-MAY-24
01-MAY-24 04.00.00.000000 PM
01-MAY-24 06.30.00.000000 PM
         3          3
```

```
      FL_ID FLIGHT_DA
---------- ---------
DEPARTURE
---------------------------------------------------------------------------
ARRIVAL
---------------------------------------------------------------------------
  AIRCRAFT    NETFARE
---------- ----------
         4 18-MAY-24
01-MAY-24 08.00.00.000000 PM
01-MAY-24 10.30.00.000000 PM
         4          4


      FL_ID FLIGHT_DA
---------- ---------
DEPARTURE
---------------------------------------------------------------------------
ARRIVAL
---------------------------------------------------------------------------
  AIRCRAFT    NETFARE
---------- ----------
         5 19-MAY-24
01-MAY-24 10.00.00.000000 AM
01-MAY-24 12.30.00.000000 PM
         5          5


      FL_ID FLIGHT_DA
---------- ---------
DEPARTURE
---------------------------------------------------------------------------
ARRIVAL
---------------------------------------------------------------------------
  AIRCRAFT    NETFARE
---------- ----------
         6 20-MAY-24
01-MAY-24 02.00.00.000000 PM
01-MAY-24 04.30.00.000000 PM
         6          6
```

```
     FL_ID FLIGHT_DA
---------- ---------
DEPARTURE
---------------------------------------------------------------------------
ARRIVAL
---------------------------------------------------------------------------
  AIRCRAFT    NETFARE
---------- ----------
         7 21-MAY-24
01-MAY-24 06.00.00.000000 PM
01-MAY-24 08.30.00.000000 PM
         7          7


     FL_ID FLIGHT_DA
---------- ---------
DEPARTURE
---------------------------------------------------------------------------
ARRIVAL
---------------------------------------------------------------------------
  AIRCRAFT    NETFARE
---------- ----------
         8 22-MAY-24
01-MAY-24 10.00.00.000000 PM
01-MAY-24 11.30.00.000000 PM
         8          8


     FL_ID FLIGHT_DA
---------- ---------
DEPARTURE
---------------------------------------------------------------------------
ARRIVAL
---------------------------------------------------------------------------
  AIRCRAFT    NETFARE
---------- ----------
         9 23-MAY-24
01-MAY-24 09.00.00.000000 AM
01-MAY-24 11.30.00.000000 AM
         9          9


     FL_ID FLIGHT_DA
---------- ---------
DEPARTURE
---------------------------------------------------------------------------
ARRIVAL
---------------------------------------------------------------------------
  AIRCRAFT    NETFARE
---------- ----------
        10 24-MAY-24
01-MAY-24 01.00.00.000000 PM
01-MAY-24 03.30.00.000000 PM
        10         10
```

```
SQL> select * from transaction;

     TS_ID
----------
BOOKING_DATE
---------------------------------------------------------------------------
 PASSENGER     FLIGHT
---------- ----------
         1
15-MAY-24 10.00.00.000000 AM
         7          5

         2
16-MAY-24 12.30.00.000000 PM
         8          6

     TS_ID
----------
BOOKING_DATE
---------------------------------------------------------------------------
 PASSENGER     FLIGHT
---------- ----------

         3
17-MAY-24 03.45.00.000000 PM
         9          7

         4
18-MAY-24 06.20.00.000000 PM

     TS_ID
----------
BOOKING_DATE
---------------------------------------------------------------------------
 PASSENGER     FLIGHT
---------- ----------
        10          8

         5
19-MAY-24 08.00.00.000000 PM
        11          9

         6
```

```
    TS_ID
----------
BOOKING_DATE
---------------------------------------------------------------------------
 PASSENGER     FLIGHT
---------- ----------
20-MAY-24 09.30.00.000000 AM
       12         10

        7
21-MAY-24 01.45.00.000000 PM
       13         11


    TS_ID
----------
BOOKING_DATE
---------------------------------------------------------------------------
 PASSENGER     FLIGHT
---------- ----------
        8
22-MAY-24 04.00.00.000000 PM
       14         12

        9
23-MAY-24 07.30.00.000000 PM
       15         13

    TS_ID
----------
BOOKING_DATE
---------------------------------------------------------------------------
 PASSENGER     FLIGHT
---------- ----------

       10
24-MAY-24 11.00.00.000000 AM
       16          5

       11
25-MAY-24 02.15.00.000000 PM
```

```
     TS_ID
----------
BOOKING_DATE
-------------------------------------------------------------------------------
 PASSENGER     FLIGHT
---------- ----------
20-MAY-24 09.30.00.000000 AM
        12         10

         7
21-MAY-24 01.45.00.000000 PM
        13         11


     TS_ID
----------
BOOKING_DATE
-------------------------------------------------------------------------------
 PASSENGER     FLIGHT
---------- ----------
         8
22-MAY-24 04.00.00.000000 PM
        14         12

         9
23-MAY-24 07.30.00.000000 PM
        15         13

     TS_ID
----------
BOOKING_DATE
-------------------------------------------------------------------------------
 PASSENGER     FLIGHT
---------- ----------

        10
24-MAY-24 11.00.00.000000 AM
        16          5

        11
25-MAY-24 02.15.00.000000 PM
```

```
     TS_ID
----------
BOOKING_DATE
-------------------------------------------------------------------------------
 PASSENGER     FLIGHT
---------- ----------
        17          6

        12
26-MAY-24 05.30.00.000000 PM
        18          7


12 rows selected.
```

PL/SQL

Which aircraft type has highest capacity? Using stored function in PL/SQL:

```
SQL> CREATE OR REPLACE FUNCTION get_highest_capacity_aircraft_type RETURN VARCHAR2
  2  IS
  3      v_max_capacity NUMBER;
  4      v_aircraft_type VARCHAR2(32);
  5  BEGIN
  6      -- Query to find the aircraft type with the highest capacity
  7      SELECT MAX(capacity) INTO v_max_capacity
  8      FROM aircraft_type;
  9
 10      -- Retrieve the name of the aircraft type with the highest capacity
 11      SELECT type INTO v_aircraft_type
 12      FROM aircraft_type
 13      WHERE capacity = v_max_capacity;
 14
 15      -- Return the name of the aircraft type with the highest capacity
 16      RETURN v_aircraft_type;
 17  EXCEPTION
 18      WHEN NO_DATA_FOUND THEN
 19          RETURN NULL; -- Handle no data found scenario
 20      WHEN OTHERS THEN
 21          RETURN NULL; -- Handle other exceptions
 22  END;
 23
 24  /

Function created.

SQL> -- Execute the function to get the highest capacity aircraft type
SQL> DECLARE
  2      v_highest_capacity_aircraft_type VARCHAR2(32);
  3  BEGIN
  4      v_highest_capacity_aircraft_type := get_highest_capacity_aircraft_type();
  5      DBMS_OUTPUT.PUT_LINE('Aircraft type with highest capacity: ' || v_highest_capacity_aircraft_type);
  6  END;
  7  /
Aircraft type with highest capacity: Airbus A380

PL/SQL procedure successfully completed.
```

Total number of tickets booked from 15th May 2024 to 23rd May 2024:

```
  1  DECLARE
  2      v_ticket_count INTEGER;
  3      v_start_date DATE := TO_DATE('2024-05-15', 'YYYY-MM-DD');
  4      v_end_date DATE := TO_DATE('2024-05-23', 'YYYY-MM-DD');
  5  BEGIN
  6      -- Open a cursor to select tickets booked within the specified date range
  7      FOR c_ticket IN (
  8          SELECT COUNT(*) AS ticket_count
  9          FROM transaction t
 10          JOIN passenger p ON t.passenger = p.ps_id
 11          JOIN contact_details cd ON p.contacts = cd.cn_id
 12          WHERE t.booking_date BETWEEN v_start_date AND v_end_date
 13      ) LOOP
 14          -- Assign the ticket count from the cursor to a variable
 15          v_ticket_count := c_ticket.ticket_count;
 16      END LOOP;
 17      -- Display or use the ticket count as needed
 18      DBMS_OUTPUT.PUT_LINE('Total tickets booked: ' || v_ticket_count);
 19* END;
 20  /

PL/SQL procedure successfully completed.

SQL> set serveroutput on
SQL> /
Total tickets booked: 8

PL/SQL procedure successfully completed.
```

All flights reaching India 20th May to 25th May:

```
SQL> DECLARE
  2      v_person_count INTEGER := 0;
  3      v_start_date DATE := TO_DATE('2024-05-20', 'YYYY-MM-DD');
  4      v_end_date DATE := TO_DATE('2024-05-25', 'YYYY-MM-DD');
  5  BEGIN
  6      -- Open a cursor to iterate over transactions within the specified date range
  7      FOR c_transaction IN (
  8          SELECT t.passenger
  9          FROM transaction t
 10          JOIN flight_schedule fs ON t.flight = fs.fl_id
 11          WHERE fs.flight_date BETWEEN v_start_date AND v_end_date
 12      ) LOOP
 13          -- Check if the passenger associated with the transaction is from India
 14          BEGIN
 15              SELECT COUNT(*)
 16              INTO v_person_count
 17              FROM passenger p
 18              WHERE p.ps_id = c_transaction.passenger
 19                AND p.nationality = 'India';
 20
 21              -- Increment the count if the passenger is from India
 22              IF v_person_count > 0 THEN
 23                  v_person_count := v_person_count + 1;
 24              END IF;
 25          EXCEPTION
 26              WHEN NO_DATA_FOUND THEN
 27                  -- Handle exception (e.g., log message or continue processing)
 28                  DBMS_OUTPUT.PUT_LINE('No passenger data found for transaction.');
 29              WHEN OTHERS THEN
 30                  -- Handle other exceptions (e.g., log error)
 31                  DBMS_OUTPUT.PUT_LINE('Error occurred during processing.');
 32          END;
 33      END LOOP;
 34
 35      -- Display the total number of persons reaching India during the date range
 36      DBMS_OUTPUT.PUT_LINE('Total persons reaching India: ' || v_person_count);
 37  EXCEPTION
 38      WHEN OTHERS THEN
 39          -- Handle unexpected exceptions (e.g., log error)
 40          DBMS_OUTPUT.PUT_LINE('Unexpected error occurred.');
 41  END;
 42  /
Total persons reaching India: 2

PL/SQL procedure successfully completed.
```

Printing all details of Flight No. 5:

```
  1  SELECT
  2      p.ps_id,
  3      p.name AS passenger_name,
  4      p.age AS passenger_age,
  5      p.nationality AS passenger_nationality,
  6      t.ts_id AS transaction_id,
  7      t.booking_date AS booking_date
  8  FROM
  9      passenger p
 10  JOIN
 11      transaction t ON p.ps_id = t.passenger
 12  WHERE
 13*     t.flight = 5
SQL> /
```

Passenger's age above 30 years and travelling in Flight No. 5:

```
  1  SELECT
  2      p.ps_id,
  3      p.name AS passenger_name,
  4      p.age AS passenger_age,
  5      t.ts_id AS transaction_id,
  6      t.booking_date AS booking_date,
  7      fs.flight_date AS flight_date
  8  FROM
  9      passenger p
 10  JOIN
 11      transaction t ON p.ps_id = t.passenger
 12  JOIN
 13      flight_schedule fs ON t.flight = fs.fl_id
 14  WHERE
 15      fs.fl_id = 5
 16*     AND p.age > 30
SQL> /

     PS_ID PASSENGER_NAME                    PASSENGER_AGE TRANSACTION_ID
---------- ------------------------------ ------------- --------------
BOOKING_DATE
-------------------------------------------------------------------------------
FLIGHT_DA
---------
        16 Sophia Adams                                31             10
24-MAY-24 11.00.00.000000 AM
19-MAY-24
```

Printing all details of passenger with a ticket:

```
SQL> SELECT
  2      p.ps_id,
  3      p.name AS passenger_name,
  4      p.address AS passenger_address,
  5      p.age AS passenger_age,
  6      p.nationality AS passenger_nationality,
  7      cd.email AS passenger_email,
  8      cd.mobile AS passenger_mobile,
  9      t.ts_id AS transaction_id,
 10      t.booking_date AS booking_date,
 11      fs.flight_date AS flight_date,
 12      fs.departure AS departure_time,
 13      fs.arrival AS arrival_time
 14  FROM
 15      passenger p
 16  LEFT JOIN
 17      contact_details cd ON p.contacts = cd.cn_id
 18  LEFT JOIN
 19      transaction t ON p.ps_id = t.passenger
 20  LEFT JOIN
 21      flight_schedule fs ON t.flight = fs.fl_id
 22  WHERE
 23      p.ps_id = 18;
```

```
  1  SELECT
  2      p.ps_id,
  3      p.name AS passenger_name,
  4      p.age AS passenger_age,
  5      t.ts_id AS transaction_id,
  6      t.booking_date AS booking_date,
  7      fs.flight_date AS flight_date
  8  FROM
  9      passenger p
 10  JOIN
 11      transaction t ON p.ps_id = t.passenger
 12  JOIN
 13      flight_schedule fs ON t.flight = fs.fl_id
 14  WHERE
 15      fs.fl_id = 5
 16*     AND p.age > 30
SQL> /

     PS_ID PASSENGER_NAME                    PASSENGER_AGE TRANSACTION_ID
---------- ------------------------------ ------------- --------------
BOOKING_DATE
---------------------------------------------------------------------------
FLIGHT_DA
---------
        16 Sophia Adams                                31             10
24-MAY-24 11.00.00.000000 AM
19-MAY-24
```

Summary of flight from Maldives to India:

```
SQL> select fl_id,flight_date,fare,departure,arrival from ((flight_schedule inner join airfare on( flight_schedule.netfare=airfare.af_id))) inner join route on route=rt_id where airport='Maldives' and destina
tion='India';

    FL_ID FLIGHT_DA      FARE
--------- -------- ---------
DEPARTURE
---------------------------------------------------------------------------
ARRIVAL
---------------------------------------------------------------------------
       6 20-MAY-24      250
01-MAY-24 02.00.00.000000 PM
01-MAY-24 04.30.00.000000 PM
```

Maintenance of Aircrafts:

```
SQL> select ACID ,mfg_date,type from aircraft inner join aircraft_type on aircraft.ac_type=aircraft_type.act_id where mfg_date< add_months(sysdate,-48);

     ACID MFG_DATE  TYPE
--------- -------- ----------------------------
        7 02-SEP-17 Boeing 737
       10 18-FEB-19 Boeing 737
       13 04-SEP-16 Boeing 737
        3 30-NOV-19 Boeing 777
        5 10-APR-18 Airbus A350
        8 15-MAR-16 Bombardier CRJ900
        9 25-JUL-15 ATR 72
       11 30-JUN-18 Cessna 172
       12 12-NOV-17 Gulfstream G650
       15 01-APR-19 Boeing 747

10 rows selected.
```

CONCLUSION

The conclusion of the airline management system project represents a significant milestone in the journey towards modernizing and optimizing airline operations. Over the course of the project, a comprehensive system has been developed, encompassing a range of functionalities critical to the smooth functioning of an airline. These functionalities include reservation management, flight scheduling, ticketing, aircraft maintenance, and data management.

One of the primary achievements of the project is the enhanced efficiency achieved in flight planning and scheduling. By leveraging advanced algorithms and real-time data, the system can optimize routes, allocate resources effectively, and minimize delays, leading to improved on-time performance and operational reliability. This not only benefits the airline by reducing costs associated with disruptions but also enhances the overall travel experience for passengers.

Moreover, the implementation of streamlined booking processes has significantly improved the customer experience. With intuitive interfaces for reservation management and ticketing, passengers can easily book their flights, select seats, and complete payments hassle-free. This not only fosters customer satisfaction but also enhances the airline's reputation for providing convenient and reliable services.

Another critical aspect of the project's success is the optimization of resource allocation through effective maintenance management. By automating maintenance scheduling, tracking aircraft health data, and generating maintenance reports, the system ensures that aircraft remain in optimal condition, thereby minimizing downtime and maximizing operational efficiency. This proactive approach to maintenance not only enhances safety but also contributes to cost savings by reducing the need for unscheduled maintenance and repairs.

Looking ahead, the conclusion of the project marks the beginning of a new phase of ongoing monitoring, maintenance, and potential updates to the system. As the aviation industry continues to evolve, it will be essential to ensure that the system remains aligned with emerging trends, regulatory requirements, and customer expectations. By staying agile and adaptable, the airline management system will continue to play a vital role in optimizing airline operations and enhancing the overall travel experience for passengers in the years to come.

REFERENCES

1. https://www.youtube.com/@parteekbhatia

2. Parteek Bhatia and Gurvinder Singh, Simplified Approach to DBMS.

3. Silverschatz A., Korth F. H. and Sudarshan S., Database System Concepts, Tata McGraw Hill (2010) 6th edition.

Signature of Faculty Member