

**By:- Data Chronicles (Team Number 24)**

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## **Introduction**

Welcome to SkyLogix, your very own Airline Management System. With the increasing demand and rush in airlines, a sophisticated management system has become essential for smooth functioning of the airline and to meet the expectations of the travelers. Our database management system is designed to efficiently and securely manage vast amounts of data related to airline operations, passenger information, and aircraft maintenance in an organized fashion.

## **Purpose**

At SkyLogix, we manage the integrities related to data storage, handling and maintenance for an Airline Company. We aim to ease your job when it comes to Flight Scheduling and Planning, Reservation and Ticketing, Crew Management, Aircraft Maintenance, Inventory Management, Passenger Services and Data Analysis and Reporting. The main purpose of the database is centralized storage where all data relevant to the airline is stored at one place instead of separate databases for meals, employees, flights and so on. This also ensures hassle-free transfer of data, if necessary as all records are well maintained and just a click away.

## **Users**

The target audience for our Database System include employees working in Airline Companies. Our software will give them access to the bigger picture than what is possible manually. This way they can keep track of operations from head to toe, thus increasing efficiency and overall experience.

## **Applications**

The Airline Companies can use the database to store details of flights scheduled, employees of their company, airports and services provided. Further, they can use the database to draw interesting conclusions like identifying the most traveled to destinations and increasing flight frequency to that location or the most preferred meal by passengers or most loyal passengers to celebrate them with benefits and make decisions like flight fares, scheduling flights, crew allotment and so on.

## **Database Requirements**

### **ASSUMPTIONS**

- For the Meal Entity Type, each instance can have food of a single variety (either Veg or Non-Veg or Vegan).
- Our Airline company has only direct flights (no connecting flights).

### **ENTITY TYPES AND IT'S ATTRIBUTES**

#### **1. Employee (Superclass)**

- Employee ID (Primary Key)
    - Data Type: Varchar (10)
  - Name (Composite Attribute)
    - First Name + Last Name
    - Data Type : Varchar(100)
  - Address (Composite Attribute)
    - Apartment Number + Street + City + State
    - Data Type: Varchar (200)
  - DOB
    - Data Type: Date
  - Age (Derived Attribute)
    - Data Type: int
    - Domain:  $18 < \text{Age} < 60$
  - Date Of Joining
    - Data Type: int
  - Nationality
    - Data Type : Varchar (100)
  - Gender
    - Data Type: Char (1)
- **Pilot (Subclass)**
    - License ID
      - Data Type: Varchar (20)
    - Flight Hours
      - Data Type: Int
    - Aircraft Type Rating
      - Data Type: Varchar (10)

- Rank
  - Data Type: Varchar (20)
- Languages Known (MultiValued Attribute)
  - Data Type: Varchar (100)
- **Flight Attendant (Subclass)**
  - Languages Known (MultiValued Attribute)
    - Data Type: Varchar (100)
  - Service Awards (MultiValued Attribute)
    - Data Type: Varchar (200)
  - Emergency Training (Multivalued Attribute)
    - Data Type: Varchar (100)
- **Ground Staff (Subclass)**
  - Role (MultiValued Attribute)
    - Data Type : Varchar (100)
  - Work Shifts (MultiValued Attribute)
    - Data Type : Varchar (50)
- **Technicians (Subclass)**
  - Specialisations (MultiValued Attribute)
    - Data Type: Varchar(100)

## 2. Flights

- Flight Number (Primary Key)
  - Data Type: Varchar (10)
- Scheduled Departure DateTime (Composite Attribute)
  - Date + Time
  - Data Type: DateTime
- Actual Departure DateTime (Composite Attribute)
  - Date + Time
  - Data Type: DateTime
- Flight Status
  - Data Type : Varchar (50)
- Scheduled Arrival DateTime (Composite Attribute)
  - Date + Time
  - Data Type: DateTime
- Actual Arrival DateTime (Composite Attribute)
  - Date + Time
  - Data Type: DateTime

### 3. Aircraft

- Aircraft ID (Key Attribute)
  - Data Type - Varchar (10)
- Manufacturer's Name
  - Data Type - Char (200)
- Model Number
  - Data Type - Varchar (20)
- Purchase Date
  - Data Type - Date
- Purchase Price (in Dollars)
  - Data Type - int
- Distance Traveled (in km)
  - Data Type - int
- Passenger Capacity
  - Data Type - int
- Cargo Capacity (in kg)
  - Data Type - int

### 4. Passenger

- Passenger ID (Primary Key)
  - Data Type: Varchar (10)
- Name (Composite Attribute)
  - Data Type: Varchar (100)
- ID Type
  - Data Type: Varchar(50)
- ID Number (Candidate Key)
  - Data Type: Varchar (50)
- Nationality
  - Data Type: Varchar (50)
- Email ID (Candidate Key)
  - Data Type: Varchar (100)
- Date of Birth
  - Data Type: Date
- Gender
  - Data Type: Char(1)
- Address (Composite Attribute)

- Apartment Number + Street + City + State
- Data Type: Varchar (200)
- Medical History (MultiValued Attribute)
  - Data Type: Char(500)

## 5. Airports

- Airport Code (Key Attribute)
  - Data Type: Varchar (20)
- Name
  - Data Type: Char (100)
- Airport Type
  - International OR Domestic
  - Data Type: Char (1)
- Location (Composite Attribute)
  - Street + City + State + Country
  - Data Type: Varchar (200)
- Number of Gates
  - Data Type: int
- Number of Belts
  - Data Type: int
- POC (MultiValued Attribute)
  - Data Type: Varchar

## 6. Meals

- Meal ID (Key Attribute)
  - Data Type: Varchar (20)
- Vendor's Name
  - Data Type: Char (100)
- Dishes Available (MultiValued Attribute)
  - Data Type: Char (50)
- Food Variety
  - Data Type: Char (30)
  - Domain: Veg/ Non-Veg/ Vegan
- Price (in Dollars)
  - Data Type: int

## 7. Ticket (Weak Entity)

- Category
  - Data Type: Varchar(50)

- Ticket Price (in Dollars)
    - Data Type: Int
  - \*Seat Allocated (Partial Key)
    - Data Type: Varchar (5)
  - \*Flight Number (Partial Key)
    - Data Type: Varchar (10)
  - Baggage Allowance (in kgs)
    - Data Type: Int
  - Meal Included
    - Domain: YES/NO
    - Data Type: Char (1)
- \* Seat Allocated and Flight Number are the Key Attributes (together)

### 8. Baggage (Weak Entity)

- Baggage ID (Partial Key)
  - Data Type: Varchar (50)
- Weight (in kgs)
  - Data Type: Int
- Color (MultiValued Attribute)
  - Data Type: Varchar (100)
- Size (Composite Attribute)
  - Length + Breadth + Height
  - Data Type : Varchar(20)

### 9. Rating (Weak Entity)

- Rating Number (Partial Key)
  - Data Type: int
- Feedback
  - Data Type: char (200)
- Stars
  - Data Type: int
  - Domain (0 < Stars < 10)

## RELATIONSHIP TYPES

### 1. Flight DEPARTS FROM Airport 1 ARRIVES AT Airport 2

- ATTRIBUTES
  - i. Departure Gate
    - 1. Data Type: Int
    - 2. Domain: 0 < Gate <= Number of gates of airport 1
  - ii. Arrival Baggage Belt
    - 1. Data Type: Int

2. Domain:  $0 < \text{Gate} \leq \text{Number of belts of airport 1}$
- iii. Type

1. Data Type: Char (1)
  2. Domain: International OR Domestic
- DEGREE - 2
  - PARTICIPATION CONSTRAINT- Flight (1,N); Airport 1(1,N); Airport 2(1,N)
  - A flight must depart from and arrive at a particular airport. Multiple flights can depart from and/or arrive at the same airport.

## 2. **Flight USES Aircraft**

- DEGREE - 2 (Binary)
- CARDINALITY- 1:1
- PARTICIPATION CONSTRAINT- Flight (1,1); Aircraft(0,1)
- A Flight must use a single Aircraft but a Aircraft may not necessarily be used by a flight (and it can be used by at most 1 flight at once).

## 3. **Passenger BOOKS Ticket INCLUDES Meal (Identifying Relationship)**

- ATTRIBUTES
  - PNR Number
    - Data Type: Varchar(50)
  - Booking ID (Key Attribute)
    - Data Type: Varchar(50)
- DEGREE - 3 (Binary)
- PARTICIPATION CONSTRAINTS- Passenger(0,N); Ticket(1,1); Meal(0,N)
- A passenger can book multiple tickets but a ticket belongs to a single passenger.
- One ticket can include only one meal however the same meal can be availed by multiple tickets.

\*If a single passenger books multiple tickets together, all will have the same PNR number but different booking IDs

## 4. **Baggage ASSOCIATED WITH Ticket (Identifying Relationship)**

- DEGREE - 2 (Binary)
- CARDINALITY- N:1
- PARTICIPATION CONSTRAINT- Baggage(1,1); Ticket(0,N)
- A single baggage can be associated with only 1 ticket but a ticket can have multiple baggages



### 5. **Ground Staff POSTED AT Airport**

- DEGREE - 2 (Binary)
- CARDINALITY- N:1
- PARTICIPATION CONSTRAINT- Ground Staff(1,1); Airport(5,20)
- A Ground Staff Member can be posted at a single Airport. Airports have at least 5 and a maximum of 20 Ground Staff Members depending on the requirement.

### 6. **Technician POSTED AT Airport**

- DEGREE - 2 (Binary)
- CARDINALITY- N:1
- PARTICIPATION CONSTRAINT- Technician(1,1); Airport(2,5)
- A Technician can be posted at a single Airport. Airports have at least 2 and a maximum of 5 Ground Staff Members depending on the requirement.

### 7. **Flight SERVES Meals**

- DEGREE - 2 (Binary)
- CARDINALITY - M:N
- PARTICIPATION CONSTRAINT - Flight(1,M);Meals(0,N)
- A flight can serve multiple meals and should serve at least one meal. It is possible that a particular meal is not served on any flight.

### 8. **Flight Attendant SUPERVISES Flight Attendant (Self Relationship)**

- ATTRIBUTES
  - Flight Number (Foreign Key)
    - Data Type - Varchar (10)
- DEGREE - 1 (Unary)
- PARTICIPATION CONSTRAINT - Head Flight Attendant(0,N); Flight Attendant (1,1)
- CARDINALITY - 1:N
- A Flight can have only one Head Flight Attendant who supervises one or more Flight Attendants.

### 9. Ground Staff MANAGES Ground Staff

- DEGREE - 1 (Unary)
- PARTICIPATION CONSTRAINT - Manager(0,N); Ground Staff(1,1)
- CARDINALITY - 1:N
- A ground staff member can manage multiple ground staff members but one member has a single manager.

### 10. Rating GIVEN BY Ticket (Identifying Relationship)

- DEGREE - 2 (Binary)
- PARTICIPATION CONSTRAINT - Rating(1,1); Ticket(1,1)
- CARDINALITY - 1:1
- A Rating can be given by a passenger traveling with a particular Ticket. A single Ticket can be used to give only one Rating.

### 11. Pilot CAPTAIN OF Flight WITH CABIN HEAD Flight Attendant HANDLED BY Ground Staff

- DEGREE - 4
- For a particular flight, we have 1 pilot, 1 flight attendant head and 1 ground staff manager.
- A pilot can captain multiple flights scheduled at different times. Similarly, the flight attendant head and ground staff manager can also handle multiple flights scheduled at different times.
- PARTICIPATION CONSTRAINT - Pilot(0,N); Flight(1,1); Flight Attendant(0,N); Ground Staff(0,N)

## Functional Requirements

### MODIFICATIONS:

#### 1) *INSERT-*

1. **Employee** entry when new employee joins
2. **Flight** schedule entry when a new flight is scheduled
3. **Aircraft** entry when a new aircraft is purchased
4. **Passenger** entry when a new passenger signs up
5. **Meal** entry when a new meal option is added
6. **Ticket** when a passenger books a ticket
7. **Baggage** entry when passenger checks in baggage
8. **Rating** entry when passenger provides feedback
9. **Airport** entry when a new airport is constructed

## 2) **DELETE**

1. **Employee** entry when an employee leaves the job
2. **Aircraft** entry when it is retired, sold or replaced
3. **Flight scheduled** entry when no longer relevant/ data cleanup
4. **Meal** entry when meal option is removed
5. **Passenger** entry when the passenger deletes their account
6. **Ticket** once flights are concluded or passenger requirements are fulfilled
7. **Baggage** once flights are concluded or passenger requirements are fulfilled

## 3) **UPDATE**

1. **Pilot** information such as license information, flight hours, aircraft type ratings, rank, or languages spoken.
2. **Flight attendant** details, including languages spoken, service awards, or emergency training.
3. **Flight scheduled** for changes in departure/arrival times, gate/terminal assignments, and flight status
4. **Aircraft** data for changes in manufacturer details, model, purchase information, capacity, or flight distance.
5. **Passenger** records for changes in personal information such as name, address, or contact details.
6. **Airport** information for changes in code, name, location, or point of contact details.
7. **Ticket** details for changes in class, price, seat allocation, baggage allowance, or meal selection.

## **RETRIEVALS:**

### 1) **SELECTION**

1. List all attributes of Ground Staff in a particular Airport.
2. List details of all Flights Scheduled that fly from Airport A to Airport B.
3. List details of all Passengers in a particular Flight Scheduled.

### 2) **PROJECTION**

1. Retrieve names of Technicians and their respective Specialization.
2. List Vendor and Price for menu planning of Meal.
3. List the Aircraft ID of Aircrafts with X Capacity.

### 3) **AGGREGATE**

1. Find the Maximum and Minimum Ticket Prices by Class.

2. Calculate the Average Rating for Flight scheduled.
  3. Calculate total weight of all checked in Baggage.
  4. Total cost of all Tickets with a given PNR.
- 4) **SEARCH**
1. Search for Aircrafts purchased after 2001.
  2. Search for Meals that contain chicken.
  3. Search for Flight Attendants based on Language spoken
- 5) **ANALYSIS**
1. Analyze the busiest Airports and the number of Flights departing from them.
  2. Find the Airport with the longest average Flight delay time.
  3. Evaluate the service quality of Flight Attendants using passenger Ratings.

## **ADDITIONAL FEATURES TO THE EXISTING DATABASE**

- In contrast to traditional airline company databases, our database includes a unique feature, storing the medical histories of passengers, which can be vital in emergency situations.
- The database allows the airline company to identify its top loyal passengers on a specific flight and this data can be used to upgrade their traveling class in case of vacant seats.
- The database retains passenger ratings for each flight, facilitating performance evaluations of employees and ensuring quality of the meals served. This, in turn, helps in recognizing and rewarding employees based on their service quality.

## **Summary**

The Airline Management System is a robust database system designed to oversee and streamline airline operations, including employee management, flight scheduling, aircraft maintenance and passenger services. This system offers extensive features for efficiently handling data, generating reports, and conducting in-depth analyses, ultimately aimed at enhancing overall airline performance and ensuring a superior passenger experience.