

Airlines Reservation System

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Project Description:

Airline Reservation System is a development of a general flight booking website. It contains information like flight schedules, routes, prices of tickets etc. The main idea of this project is to implement an online reservation system that could allow customers to book flights with ease. The system displays the available flights and enables you to buy tickets. There are many airlines, routes and passengers with which our application would be useful to keep track of the Airline information and do analysis on it.

Business rules and Entities:

1. **Aircrafts** (Aircraft_id, Capacity, Company) - It has information regarding Aircrafts about which company they are made from, number of seats of the company etc. An aircraft can be used multiple times as a flight for traveling.

Aircraft_id - Primary key identifier which uniquely identifies each aircraft.

Capacity - Maximum Number of seats that aircraft holds.

Company - The company the aircraft belongs to.

2. **Airports** (Airport_name, Lat, Long, City, State, Country, Iata_code) - It has the information about the different Airports the planes can travel to. Airports can be used as a source and destination for many different routes.

Airport_name - Unique Name of the airport, And airports do not have the same name.

Lat - Latitude of the airport.

Long - Longitude of the airport.

Lat, Long uniquely identifies the location of an airport.

City - City of the airport.

State - State of the airport.

Country - Country of the airport.

Iata code - a unique code given to the city of the airport

3. **departfrom_Routes_arriveto** (Route_id, Destination, Source, Route, Stops) - It has information about which route the flight would be taking along with the number of stops. There is a **Participation constraint** from routes to airports because each route will only have one source and one destination.

Route_id - Primary identifier of route.

Destination - Destination airport of the flight. Foreign key reference from Airports.

Source - Source airport of the flight. Foreign key reference from Airports.

Route - Has the route between source and destination like 'NYC -> SF -> NC' etc.

Stops - Number of stops in the route.

4. **Flights** (Flight_id, Flight_name, Route_id , Arrival_date, Arrival_time, Duration, Aircraft_id, Departure_date, Departure_time) - It has information about the schedule

of a flight. It describes the travel information an user can see. There is a **Participation constraint and key constraint** from flights to aircrafts and routes because each flight schedule should only be traveling in one aircraft and only in one route.

Flight_id - primary key identifier which uniquely identifies each flight.
Flight_name - Name of the Airline company the flight schedule is with.
Route_id - Unique number of routes.Foreign key reference from Routes.
Departure_time - Time of departure.
Departure_date - Date of departure.
Duration - Number of hours it takes to reach a destination.
Aircraft_id - Unique number of aircraft. Foreign key reference from Aircrafts.
Arrival_time - Time of arrival.
Arrival_data - Date of arrival.

5. **Costs** (Cost_id,Amount,Type,Class,Location) - It has information regarding the cost of a ticket on that plane based on the class of the seat and different ages of travelers. Combination of passenger type, seat location and class determines the cost.

Cost_id - primary key identifier which uniquely identifies each cost of a ticket.
Amount - Numerical amount
Location - Describes the seat location - Aisle,Middle,Window.
Class - Describes seat class - Business or Economy.
Type - Adult, kid

6. **Passengers** (Passenger_id, Name, Email, Phone_number, Type) - It has information about passengers.

Passenger_id - primary key identifier which uniquely identifies each passenger.
Name - First name of the passenger.
Email - Email id of the passenger.
Phone_number - Phone number of the passenger.
Type - Type of the passenger - adult or child

7. **Tickets** (Ticket_id, Cost_id, Passenger_id, Seat_number, flight_id) - It has all the ticket transactions done so far whether they may be canceled or not. A combination of Passenger id, seat number and flight id determine the ticket. There is a **participation constraint and key constraint** from tickets to passengers and seats because each ticket transaction may only have one passenger and one seat booked by them.

Ticket_id - A primary key identifier which uniquely identifies each ticket.
Cost_id - A foreign key regarding the cost of the seat in the flight
Passenger_id - A foreign key regarding the passenger of this ticket
Seat_number - A foreign key regarding the seat number of the passenger
flight_id - A foreign key regarding the flight of the passenger

8. **have_Seats** (Seat_number, Flight_id, Cost_id) - It has information about the seats in a particular flight. Seats are a **Weak Entity** because without flights seats shouldn't exist. Each seat belongs to one flight and each flight will have multiple seats. A combination of flight_id and seat_number gives the seat info. There is a **participation constraint and key constraint** on seats because each seat will have one cost but the same cost can be used for multiple seats.

Seat_number - Unique identifier which uniquely identifies each seat.

Flight_id - Unique Number of the flight that contains the seats. Foreign key reference from Flights.

Cost_id - Foreign key references from costs.

9. **Charges** (Charge_id, Charge_type, Charge_amount) - It contains information about the additional charges of a particular passenger - Extra baggage, No-show fee, Cancellation fee, Ticket changes fee.

Charge_id - primary key identifier which uniquely identifies each charge of a passenger.

Charge_type - Description of the type of charge - extra_bag or cancellation etc.

Charge_amount - Cost of the additional charges for the passenger.

10. **Tickets_have_charges** (Ticket_id, Charge_id) - Each ticket can have multiple charges and multiple charges can be in different tickets. Therefore, it is given its own entity. Both of them combined are given as primary key.

Ticket_id - Foreign key references tickets

Charge_id - Foreign key references charges

11. **Pilots** (Pilot_id, Pilot_name) - It contains information about Pilots who fly the flights.

Pilot_id - primary key uniquely identifies each pilot.

Pilot_name - name of the pilot.

12. **Fly** (Flight_id, Pilot_id) - Since each flight can be flown by many pilots and each pilot can fly many flights, A separate entity is created for that.

Pilot_id - foreign key uniquely references each pilot.

Flight_id - foreign key uniquely references each flight.

Primary key is both flight_id and pilot_id.

Data population:

1. To take a realistic data and do data analysis on it, we have selected datasets from resources:
<https://data.humdata.org/dataset/ourairports-ind>
<https://www.kaggle.com/datasets/nikhilmittal/flight-fare-prediction-mh>
2. We couldn't use the data as it is because there are many missing values and too many columns. So the data was manually cleaned and broken down to multiple CSV files to populate each table separately.

3. For airports, routes, flights and aircrafts we used the cleaned data from those CSVs. And for all others like Passengers, Tickets, Pilots, Seats, Charges and Costs, realistic information was manually created by referring to some online resources such as the following.

<https://www.airindia.in/usa-preferred-seat-scheme.htm>

<https://www.airvistara.com/in/en/coronavirus-update>

Queries to look into and Results:

- With the help of this application, a user is able to see the flights traveling from and to the given cities selected by the user.

	flight_name	source	departure_airport	departure_date	depart	duration	arrival_airport
0	Vistara	New Delhi	Indira Gandhi International Airport	2019-06-27	06:00	3h 10m	Cochin In
1	IndiGo	New Delhi	Indira Gandhi International Airport	2019-03-04	20:25	5h 5m	Cochin In
2	Air India	New Delhi	Indira Gandhi International Airport	2019-05-18	12:00	19h 40m	Cochin In
3	Vistara	New Delhi	Indira Gandhi International Airport	2019-04-21	14:40	3h 10m	Cochin In
4	IndiGo	New Delhi	Indira Gandhi International Airport	2019-06-15	02:00	5h 25m	Cochin In

- Statistical description type questions such as

- For any data analysis, the first thing to do would be the statistical descriptors such as Minimum, Maximum of the airline capacity, number of stops, cost based on flight, source and destination.

Statistical Descriptions

Understanding the min, max values could help passenger make choices with their trip.

These are the current options available to check the aggregates - Number of Stops, Costs of a flight and Total Seat capacity.

Minimum of What should be checked?

Capacity X Number of Stops X Cost X

Maximum of What should be checked?

Capacity X

Select what values to visualize along with the aggregates. Currently the choices are Flight names, Source airport, Destination airport.

Which values should be used to see the aggregates independently

Flight names X

Display the Aggregates

	flight_name	min_	min_	min_cost	max_
0	Jet Airways	254	0	13500	254
1	Air India	256	0	4500	256
2	SpiceJet	149	0	5500	149

3. Data analytics type questions such as

- Which flights are prone to ticket cancellations by the passengers? Which flights, seat locations, classes are mainly associated with the extra charges paid by the passengers? The economy class passengers seem to always have extra charges but this could be associated with a plane having lesser business class seats.

Choose what ranking is needed

Seat Class

Choose the Charge on which the ranking should be based on

Ticket Cancellation

Most frequently the fee for Ticket Cancellation is charged whenever Seat Class is as economy.

Display the Ranking for Seat Class

	class	num
0	economy	28
1	business	21

- Recommendation lists (popularity) based on number of passengers, affordable ticket prices and a combination of both. The popularity of different flights are identified by looking at the flights that has the most number of bookings. The affordability of flights is identified by looking at the flights having the cheapest price. From this, the top best flights suited for travel is inferred by flights having larger bookings and cheaper prices.

Recommendation Lists

Recommendation List based on popularity

A recommendation list of flights for passengers is displayed by sorting the Flight name and the most number of bookings made for that particular flight.

A curated list of flights with the most popularity among passengers.

	flight_name	num
0	Vistara	41
1	Air India	30
2	IndiGo	30
3	SpiceJet	29
4	Jet Airways	10

Recommendation List based on affordable price

A recommendation list of flights for passengers is displayed by sorting the Flight name and the cheapest price for that particular flight.

A curated list of flights with the most affordable ticket prices.

	flight_name	minimum_cost
0	IndiGo	3500
1	Air India	4500
2	SpiceJet	5500
3	Vistara	7000
4	Jet Airways	13500

Best Flights to travel

A list of best flights for passengers is displayed by the Flight name having the most number of bookings as well as cheapest price for that particular flight.

A curated list of flights with the best price and more bookings.

	flight_name
0	Vistara
1	Air India
2	IndiGo
3	SpiceJet
4	Jet Airways

- The cost estimates for a particular seat is identified by providing the seat location, class, passenger type and the additional charges. From this, the estimated cost for a particular passenger can be calculated.

Estimation of Ticket Prices

The price of a ticket can be estimated based on the passenger type, class, seat location and additional charges like baggage, cancellation fees etc. The estimation of a ticket price is calculated by adding the minimum price of the particular seat, class and location and the minimum price of the additional charges for a particular charge type.

Choose a passenger type

adult

Choose a class

economy

Choose a passenger type

aisle

Choose a additional charge type

Extra Baggage

The estimated ticket price of a passenger is displayed.

	type	class	location	charge_type	estimated_price
0	adult	economy	aisle	Extra Baggage	4900

- The total charge for a given ticket id is found by adding the base price of the ticket and the additional charges on that particular passenger.

Total Charges

Total price of a ticket

The total price of a ticket given its Ticket ID is displayed by adding the actual price of the ticket and any additional charges present for that Ticket.

Choose a Ticket ID

5

The total price for the Ticket is:

	0
ticket_id	5
ticket_price	10000
additional_charges	3250
total_price	13250

- The list of the timings of the available flights between a particular source and destination can be found by taking departure time of the flight and if the departure time is between 6 AM and 6 PM are taken as day time flights and remaining as night time flights.

Display Flights based on time

The details of flights available between a particular source and destination is taken and sorted based on the departure time of the flight. All flights between 6 AM to 6 PM refers as day time flights and the remaining flights as night time flights.

Choose a source

Chennai

Choose a destination

Kolkata

The details of flights available during day and night time are displayed.

	flight_id	flight_name	depart	time_c
0	49	Vistara	07:05	day
1	2	SpiceJet	17:45	day
2	27	Vistara	17:45	day
3	37	Vistara	17:45	day
4	59	IndiGo	05:15	night

ER DIAGRAM:

