CMPE 226 FALL 2015
TEAM PROJECT REPORT
Airline Reservation System

Submitted By

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1. Introduction

The airline reservation system is an application developed to help customers in reserving a flight between airports of his/her choice. The user can select the source and the destination airports on a specific date and our application will show all the available routes between the two selected airports with different airlines and prices. The user can make reservation by choosing any one of the routes available. This application calculates fare for the flight depending on the distance between the two airports. The user can see his/her itinerary based on the reservation and a unique code generated at the time of booking.

The whole project is implemented using PHP and HTML scripts and is integrated with the mySQL database.

Following are some of the key features of this application:

- Large and Extensive Datasets to cover the maximum possible destinations.
- Source and destination selection
- Route query and selection
- Fare estimation
- Airport Information
- Itinerary generation after a successful transaction
- Autocomplete text feature to display information and is implemented using JQuery and Ajax

Figure 1 gives a pictorial representation of the extensive dataset used for the application

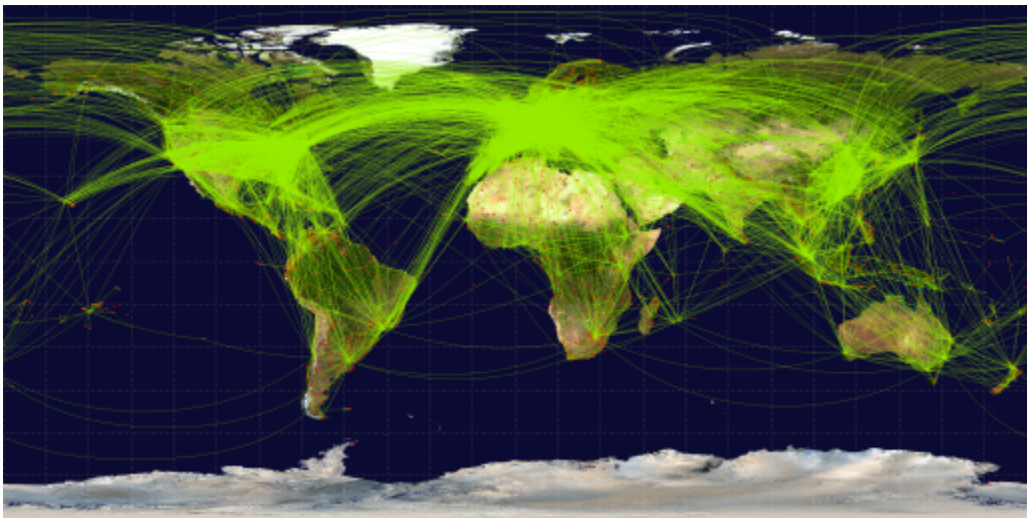


Figure 1

2. Data Source

All the data has been retrieved and used from the following websites.

- http://www.cleartrip.com/api/docs/air-api/
- https://flightaware.com/commercial/flightxml/
- http://flightwise.com/
- http://openflights.org/data.html

Three large and extensive datasets are used to perform queries and search operations

Route dataset:

Our Route Dataset contains **65000** routes between **3209** airports on **531** airlines spanning the globe, as shown in the map above. Each entry contains the following information:

Airline	2-letter (IATA) or 3-letter (ICAO) code of the airline.
Airline ID	Unique OpenFlights identifier for airline.
Source airport	3-letter (IATA) or 4-letter (ICAO) code of the source airport.
Source airport ID	Unique OpenFlights identifier for source airport.
Destination airport	3-letter (IATA) or 4-letter (ICAO) code of the destination airport.
Destination airport ID	Unique OpenFlights identifier for destination airport.

Airport dataset:

Our Airports Dataset contains **6977** airports spanning the globe, as shown in the map above. Each entry contains the following information:

Airport ID	Unique OpenFlights identifier for this airport.
Name	Name of airport. May or may not contain the City name.
City	Main city served by airport. May be spelled differently from Name.
Country	Country or territory where airport is located.
IATA/FAA	3-letter FAA code, for airports located in Country "United States of America". 3-letter IATA code, for all other airports. Blank if not assigned.
ICAO	4-letter ICAO code. Blank if not assigned.
Latitude	Decimal degrees, usually to six significant digits. Negative is South, positive is North.
Longitude	Decimal degrees, usually to six significant digits. Negative is West, positive is East.

Airline database:

Airlines Database contains **5888** airlines. Each entry contains the following information:

Airline ID	Unique OpenFlights identifier for this airline.
Name	Name of the airline.
IATA	2-letter IATA code, if available.
ICAO	3-letter ICAO code, if available.
Country	Country or territory where airline is incorporated.

3. Overview of Data Models

We have used the following SQL techniques to use the data in the database.

- Inner Joins
- Outer Joins
- Create views and tables
- 1:M, M:N relationships
- Normalization -3NF

Inner joins: An inner join (or simply Join) displays all the data from the tables that are joined when there is a match in the columns.

1. **Query to fetch flight details:**

```
SELECT r.Name as AirlineID, s.`Airport ID` as SourceID, d.`Airport ID` as DestinationID
FROM Airports s, Airports d, Finalroutes r WHERE s.City = "San Francisco" and d.City
= "Chicago" and s.`Airport ID` = r.`Source ID` and d.`Airport ID` = r.`Destination ID`
```

2. **Query to fetch route details:**

```
$sql = "SELECT r.Name as `Airline Name`, s.City, s.Name as `Origin Airport
Name`,d.City,d.Name as `Destination Airport Name` FROM Airports s, Airports d,
Finalroutes r WHERE s.City = '$origin' and d.City = '$destination' and s.`Airport ID` =
r.`Source ID` and d.`Airport ID` = r.`Destination ID` "
```

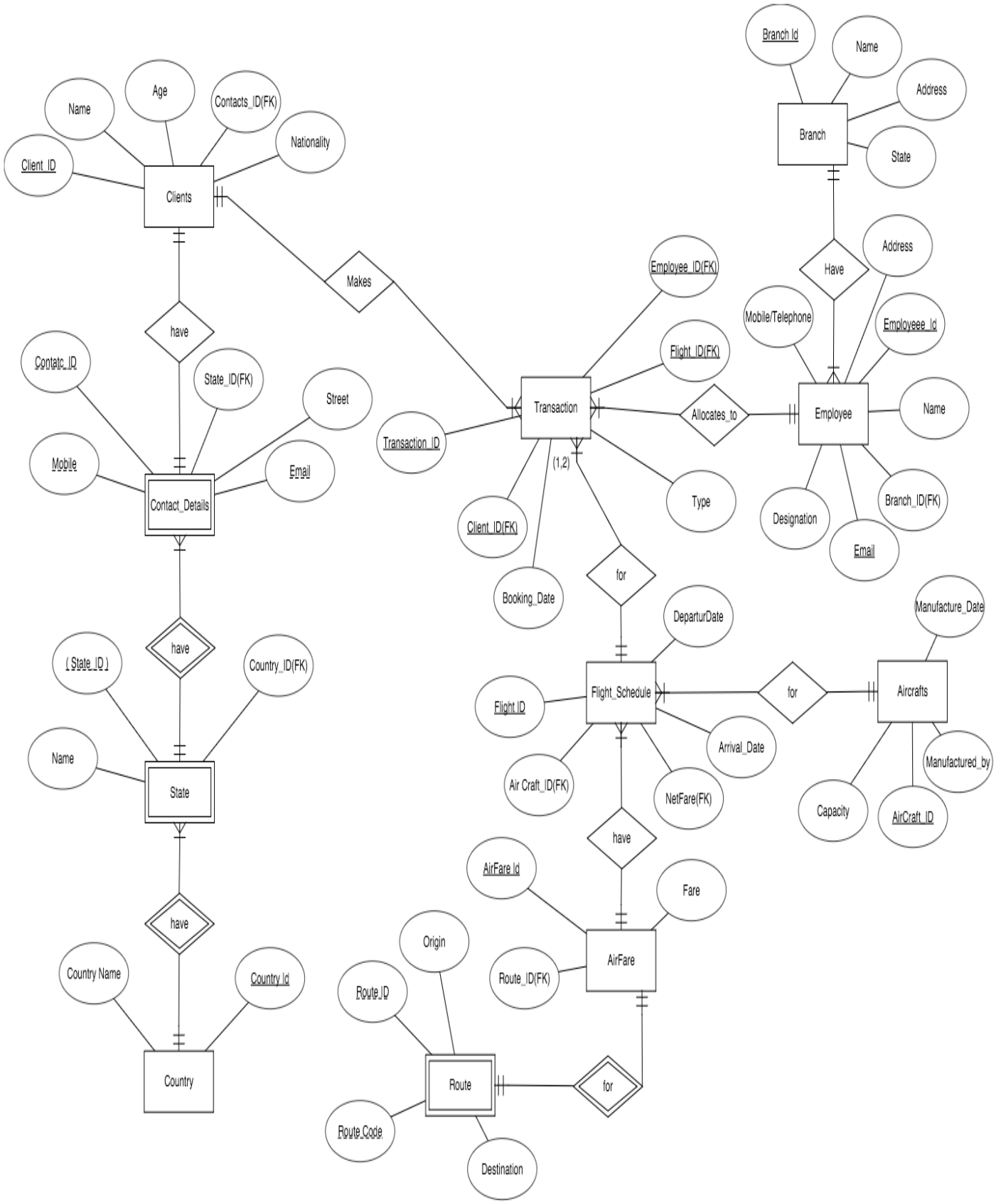
3. **Query to fetch airport details:**

```
$sql = "SELECT * from airports where name = '$name' ";
```

4. **Query to fetch Airline details:**

```
$sql = "SELECT * from airlines where name = '$name' ";
```

4. ER diagram


Branch Id
Name
Address
Branch
State
Have
Address
Mobile/Telephone
Employeee_Id
Employee
Name
Designation
Branch_ID(FK)
Email
Employee_ID(FK)
Flight_ID(FK)
Transaction
Allocates_to
Transaction_ID
(1,2)
Type
Client_ID(FK)
Booking_Date
for
DepartureDate
Flight_Schedule
Flight ID
Arrival_Date
Air Craft_ID(FK)
NetFare(FK)
have
AirFare Id
Fare
AirFare
Route_ID(FK)
Origin
Route ID
Route
for
Route Code
Destination
Manufacture_Date
for
Aircrafts
Manufactured_by
Capacity
AirCraft_ID
Makes
Clients
Name
Age
Contacts_ID(FK)
Nationality
Client_ID
have
Contatc_ID
State_ID(FK)
Street
Mobile
Email
Contact_Details
have
State_ID
Country_ID(FK)
Name
State
have
Country Name
Country Id
Country

A client has attributes like a unique id, age, name, nationality and contact details. Contact Details have multiple attributes like a unique mobile, state ID, a unique email and street address. Each client can have only one Contact Detail and each contact detail belongs to only one client.

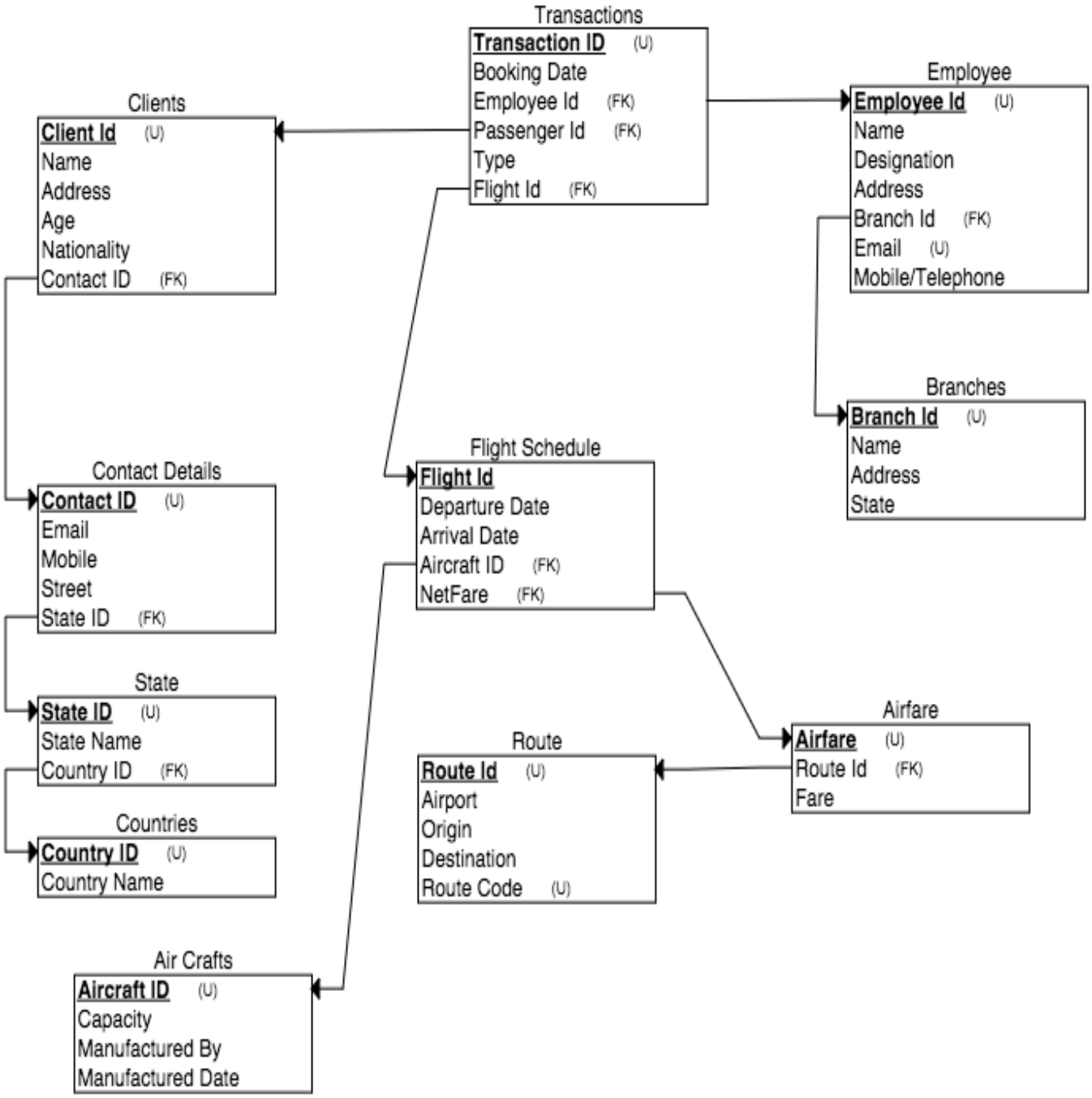
Each Contact Detail has only one State entity. Additionally, Each State has attributes like name of the state, country. Similarly, Each country has a country name and country id. Each state belongs to only one country and each country can have multiple states.

A transaction will have multiple attributes like an auto generated transaction id, Booking Date, Client ID, Booking Type, Flight ID and Employee ID. Type refers to the type of transaction (E.g. Reservation and Cancellation) and it has only two values such as 0 and 1(0 refers to cancellation and 1 refers to reservation).

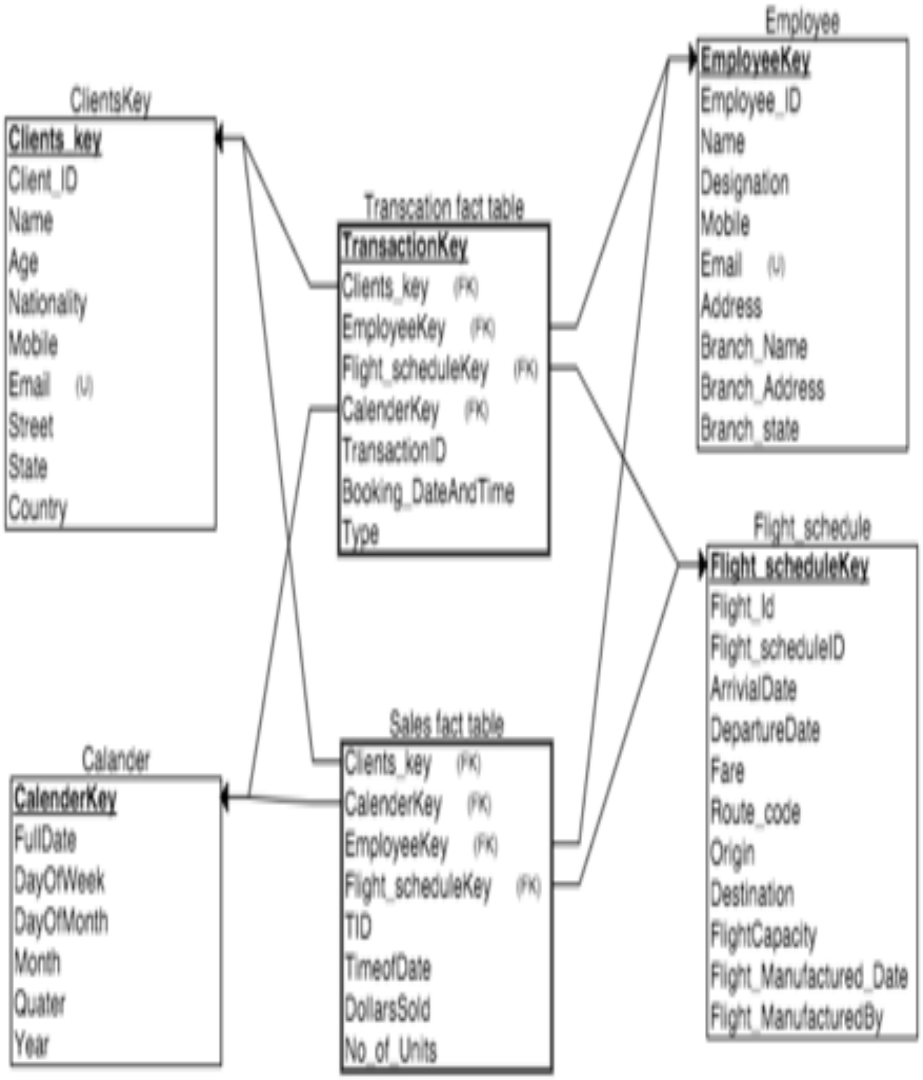
Each client can make multiple transactions. A transaction is unique and can be made by only one client.
Each transaction is allocated to only one employee. And each employee can handle multiple transactions.
A flight schedule has details of the trip like flight ID, Arrival date, Departure date etc.
Each transaction has only one flight schedule.
Each flight schedule can have multiple transactions (at least one and at most two).
Each Flight schedule can be operated by only one particular aircraft.
An aircraft has details like capacity, manufacturing date, manufacturer etc.
Each flight schedule has only one airfare and each airfare can have multiple flight schedules.
An Airfare has details like unique airfare id and fare. An airfare is mentioned for only one route.

A route has details like route id, origin, destination etc.
Each route has only one airfare.
An employee has details like name, unique employee id, mobile number, email, designation etc. Each employee works in only one particular branch.
A branch can hold multiple employees. Each branch has a unique branch id, name, address etc.

5. Relational schema



6. Star Schema



Sample Data from the airport table:

+ Options

Airport ID	Name	City ▲ 1	Country	IATA/FAA	ICAO	Latitude	Longitude
8404	South Cariboo Regional Airport	108 Mile Ranch	Canada	ZML	CZML	51.441200000000	-121.19580000000000
6472	Aaa	Aaa	Maldives		\N	73.900000000000	3.22200000000000
8767	Aachen HBF	Aachen	Germany		\N	50.766700000000	6.10000000000000
4165	Flugplatz Merzbrueck	Aachen	Germany	AAH	EDKA	50.823194000000	6.18638900000000
628	Aalborg	Aalborg	Denmark	AAL	EKYT	57.092789000000	9.84916400000000
385	Aalen Heidenheim Elchingen	Aalen-heidenheim	Germany		EDPA	48.777833000000	10.26466700000000
8906	Station Aare	Aare	Sweden		\N	63.398779000000	13.07595600000000
607	Aarhus	Aarhus	Denmark	AAR	EKAH	56.300017000000	10.61900800000000
3997	Aasiaat	Aasiaat	Greenland	JEG	BGEM	68.700000000000	-52.75000000000000
2097	Abadan	Abadan	Iran	ABD	OIAA	30.371111000000	48.22833300000000
7320	Abaiang Atoll Airport	Abaiang Atoll	Kiribati	ABF	NGAB	1.800000000000	173.04000000000000
2955	Abakan	Abakan	Russia	ABA	UNAA	53.740000000000	91.38500000000000
1372	Abbeville	Abbeville	France		LFOI	50.143492000000	1.83189200000000
175	Abbotsford	Abbotsford	Canada	YXX	CYXX	49.025278000000	-122.36055600000000
2126	Ghazvin Azadi	Abe-ali	Iran		OIIA	35.952097000000	50.45077800000000
997	Abeche	Abeche	Chad	AEH	FTTC	13.847000000000	20.84433300000000
7590	Abemama Atoll Airport	Abemama	Kiribati	AEA	NGTB	0.490833000000	173.82861100000000
9285	Aberdeen Harbour	Aberdeen	United Kingdom		\N	57.139670000000	-2.07467000000000
3772	Phillips Aaf	Aberdeen	United States	APG	KAPG	39.466219000000	-76.16880800000000
5714	Aberdeen Regional Airport	Aberdeen	United States	ABR	KABR	45.449100000000	-98.42180000000000
7386	Aberdeen Railway Station	Aberdeen	United Kingdom		\N	57.143600000000	-2.09850000000000
532	Dyce	Aberdeen	United Kingdom	ABZ	EGPD	57.201944000000	-2.19777800000000

7. Application Screenshots and Features

The Airport Database consists of more than 8000 records of airports all over the globe. This is the sample of the data available in the airports database. The Table has eight columns namely, Airport ID, Name, City, Country, IATA/FAA, ICAO, Latitude, longitude.

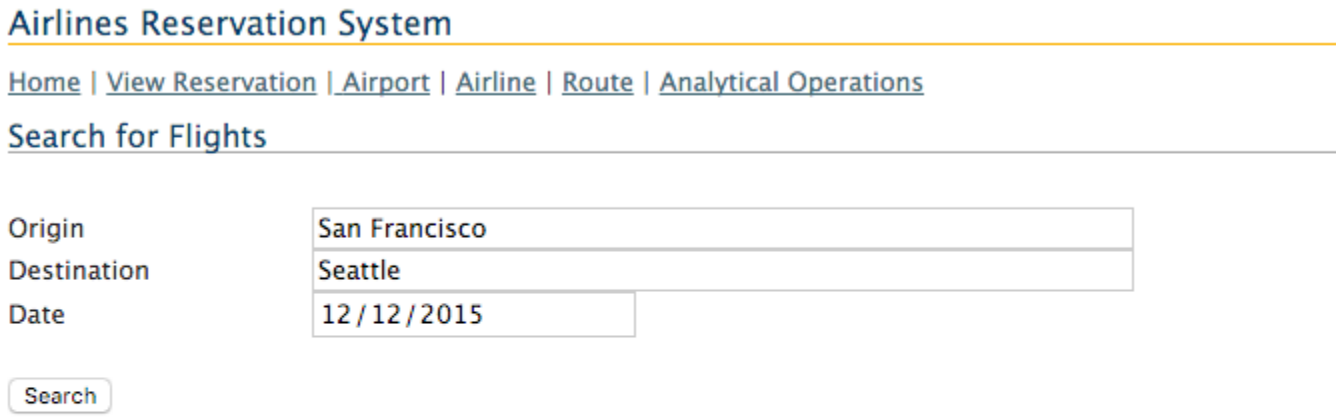
Fare Calculation:

The fare is calculated with the help of the distance between two airports. The co-ordinates (latitude and longitude) of airports are retrieved from the table and with the help of **haversine** formula the distance is calculated.

Each airline can have a different surcharge so the prices may vary depending on the airlines selected.

The process of the airline booking:

The user is presented with a homepage on which he/she is prompted to select his/her source airport and the destination airport. When the user starts typing, the data entered is matched with the database of airports at the same time resulting in a drop down menu with available (matching) names of the airport. The user can select the desired source airport from the menu. The destination airport tab also has same functionality from which user selects his/her destination airports. After the user has selected the source and the destination airports, the user can select the date of departure from the drop down calendar menu.



When the user has completed all the entries and clicks on the make reservation option, a new window opens which displays all the available airline carriers between the source and the destination for that date and the fare for travel.

Airlines Reservation System

Home | View Reservation | Airport | Airline | Route | Analytical Operations

Available Flights Information

select	Airline Name	Origin City Name	Origin Airport Name	Destination City Name	Destination Airport Name	Fare	Date
○	American Airlines	San Francisco	San Francisco Intl	London	Heathrow	1226.99	2015-12-16
○	Finnair	San Francisco	San Francisco Intl	London	Heathrow	1226.99	2015-12-16
○	British Airways	San Francisco	San Francisco Intl	London	Heathrow	1226.99	2015-12-16
○	Delta Air Lines	San Francisco	San Francisco Intl	London	Heathrow	1226.99	2015-12-16
○	Iberia Airlines	San Francisco	San Francisco Intl	London	Heathrow	1226.99	2015-12-16
○	Lufthansa	San Francisco	San Francisco Intl	London	Heathrow	1226.99	2015-12-16
○	Air New Zealand	San Francisco	San Francisco Intl	London	Heathrow	1226.99	2015-12-16
○	United Airlines	San Francisco	San Francisco Intl	London	Heathrow	1226.99	2015-12-16
○	Transaero Airlines	San Francisco	San Francisco Intl	London	Heathrow	1226.99	2015-12-16
○	Virgin Atlantic Airways	San Francisco	San Francisco Intl	London	Heathrow	1226.99	2015-12-16

Make Reservation | Go Back

When the user has selected the airline he/she is taken to a booking page, where the user enters his contact details and entered his payment information , an itinerary is generated which contains the details about the customer and his/her flight details with a unique booking ID. The booking ID is unique for each user and can be used to check the itinerary at a later time. The user can also print the itinerary for safekeeping.

Airlines Reservation System

Home | View Reservation | Airport | Airline | Route | Analytical Operations

Payment

Personal Details

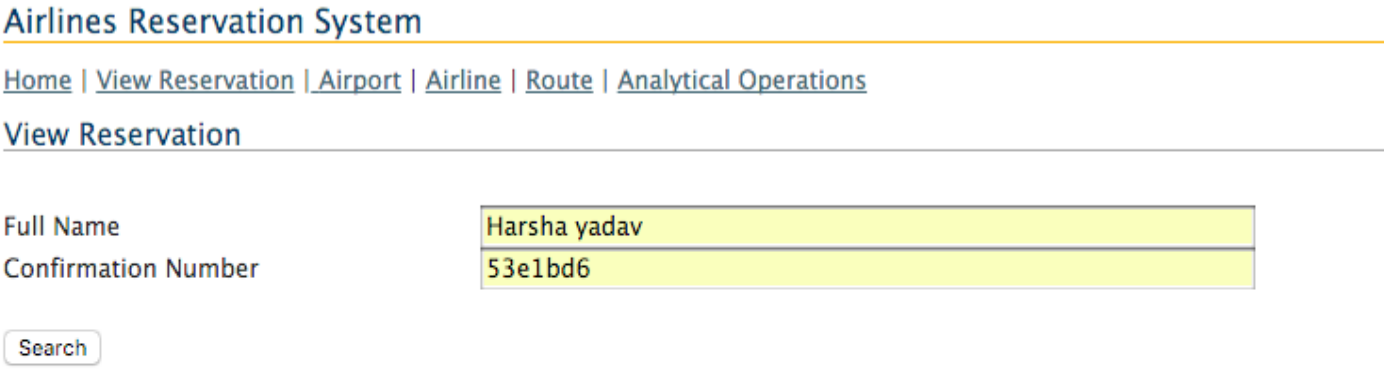
Full Name	Harsha yadav
Age	24
Gender	Male
Nationality	India
Mobile Number	4088131411
Email	kharshayadav@gmail.com
Street	1060 S 3rd Apt 343
State	California
Country	United States

Credit card details

Credit Card Number	1234123412341234
Expiry Date	12/17
Cvv	748

Make Reservation

The user can view the itinerary by clicking the view reservation tab on the homepage on the top. The User is prompted to enter his/her full name along with the unique booking ID. Once the user has entered the correct information and click on submit, his/her itinerary is displayed on the screen.

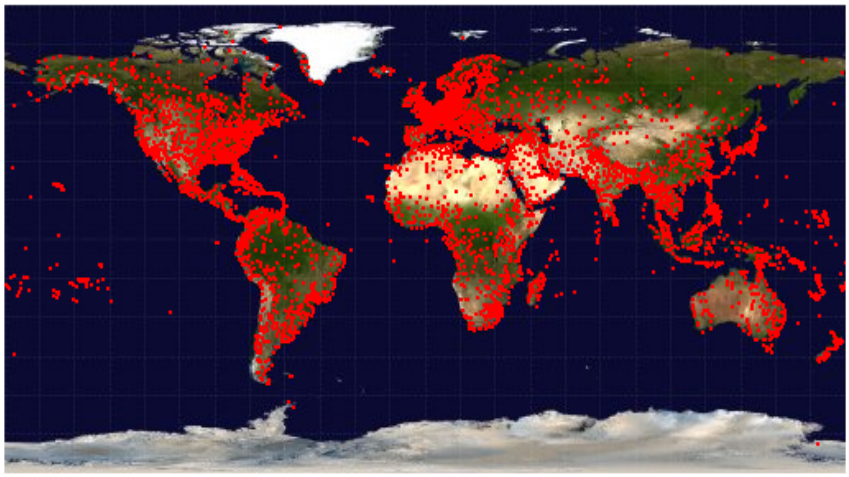


The user can also search for the details of an airport by clicking on the airports tab on the top of the page.

Airlines Reservation System

Home | View Reservation | Airport | Airline | Route | Analytical Operations

Airport database



(click to enlarge)

Search for Airport

seattle Search

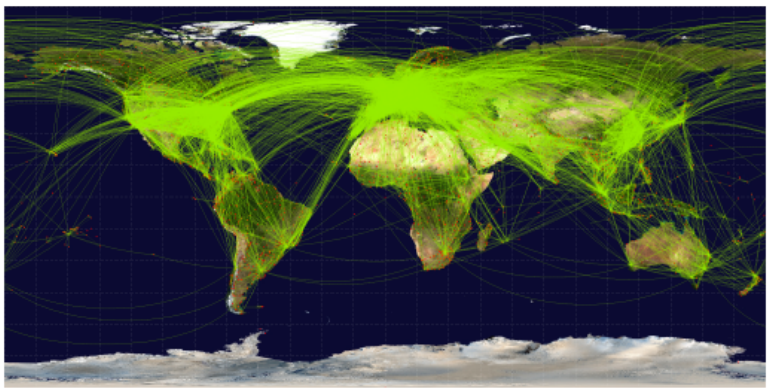
In the above picture, each red dot represents an airport and as such all the airports in the database are represented by red dots all over the globe.
The user can search for his/her desired airport name and click on the search button to get the details about the airport.

The user can also search for the available routes between two airports and if there is any route available between two airports by clicking on the routes option on the top of the page and entering the source and the destination airport names.

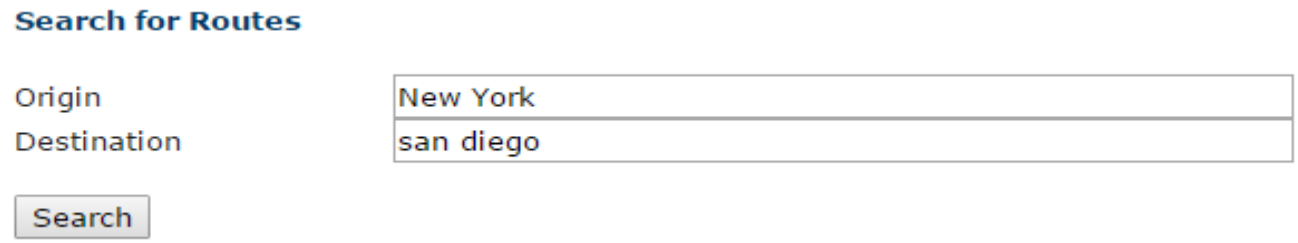
Airlines Reservation System

Home | View Reservation | Airport | Airline | Route | Analytical Operations

Route database

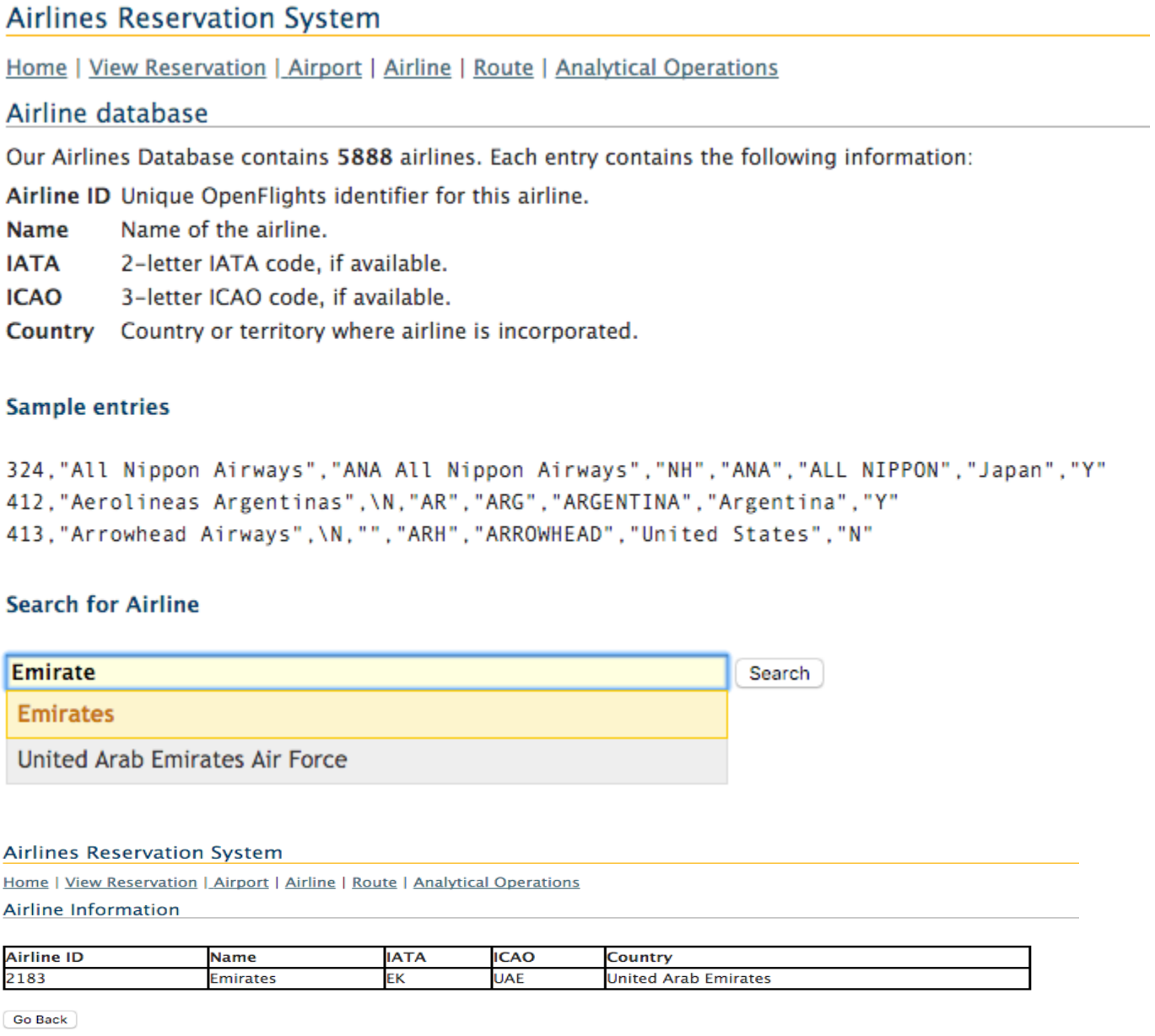


(click to enlarge)



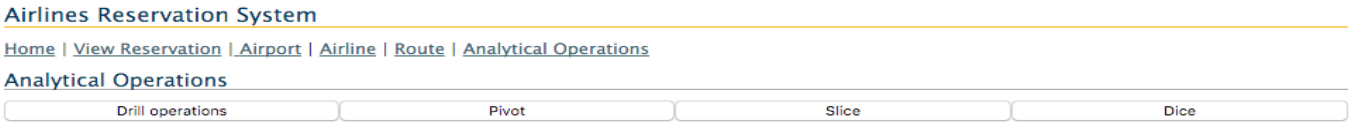
When the user clicks on the search button a new page is displayed about the available routes information. Each green line represents a route between two airports and as such all the available routes between the airports all over the globe are represented in the above image.

A user can search for information of a particular airline in Airline tab. A new window will display Airline Information.

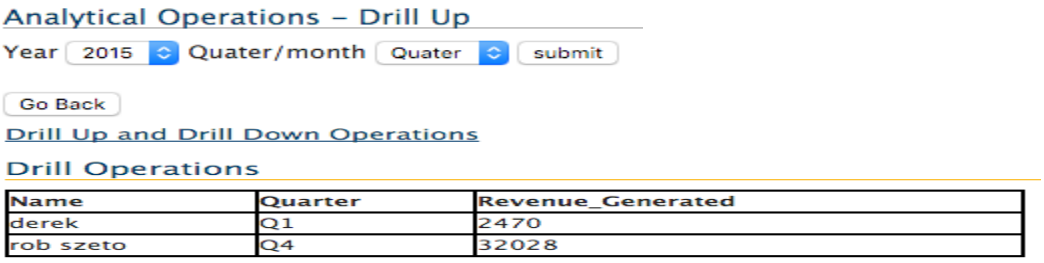


8. Analytical Operation

Our Application supports the following Analytical operations:



1. Drill up/down operations:



Name	Quarter	Revenue_Generated
derek	Q1	2470
rob szeto	Q4	32028

2. Pivot:

Before Pivot

Name	Quarter	Revenue_Generated
rob szeto	Q1	7396
derek	Q3	2470
rob szeto	Q4	32028

After Pivot

Name	Q1	Q3	Q4
rob szeto	7396		
derek		2470	
rob szeto			32028

3. Dice:

Before Dice

Name	Quarter	Revenue_Generated
rob szeto	Q1	7396
derek	Q3	2470
rob szeto	Q4	32028

After Dice

Name	Quarter	Revenue_Generated
derek	Q3	2470
brucewayne	Q4	27316

4. Slice:

Before Slice

Name	Quarter	Revenue_Generated
rob szeto	Q1	7396
derek	Q3	2470
rob szeto	Q4	32028

After Slice

Name	Quarter	Revenue_Generated
rob szeto	Q1	7396

9. Technology Stack & Database Concepts Implemented

- HTML,CSS,JavaScript
- MySQL
- RDBMS
- Data Warehousing Concepts
- PHP
- Ajax
- Jquery
- XAMPP
- Cisco Information Server
- Tableau + Google Maps API

10. Conclusion

Airline Reservation Application is an advanced and practical application that helps the customers in travelling to other places by displaying flight routes and fares to a specific destination. Additionally, it also supports tracking back the transactions done by the users.
Airline reservation application is achieved with the help of an extensive and elaborate dataset of 65000 air routes and 8500 flight information. Many concepts like the inner join, outer join, star schema, normalization, analytical operations etc. are implemented in the airline reservation system to produce the final product.
Also, HTML, PHP and CSS scripts are used to generate and design an interactive UI for the user which facilitates in easy and efficient reservation.

11. References

[1] (). *ClearTrip*. Available: http://www.cleartrip.com/api/docs/air-api/.
[2] (). *Flight Aware*. Available: https://flightaware.com/commercial/flightxml/.
[3] (). *Flight Wise*. Available: http://flightwise.com/.