**Project-1**

**Revenue & Commercial Forecasting Model**

**PROBLEM STATEMENT:**

Airline client usually have decent load factor and smooth operation but not able to increase revenue and struggling to break-even.

This is mainly due to following factors:

* + Poor/No Revenue Management
  + Revenue dilution
  + Sub-optimal seat allocation
  + Poor/No over-booking management
  + No fare audit due to lack of insight
  + Increase in opportunity cost
  + Loss of Business

**SOLUTION:**

Design and Implement an End-to-End ML model with the help of historical data and current live data that is being generated flight by flight basis.

The solution consists of the following functionality:

* + Seasonality Prediction – Clustering approach
    - Peak Season (demand exceeds capacity)
    - Off-peak season (demand is less than capacity)
    - Shoulder season (demand meets capacity)
  + Flight Categorization – Classification approach
  + Sales Prediction – Regression approach
  + Effective Seat allocation Strategy – Time Series approach
    - Avoiding revenue dilution
    - Effective overbooking management with analysis of NO-SHOW data
    - Optimal pricing with right fare audit

With the above functionality put in place effectively lead to effective revenue management.

With the implementation, increase in sales of 15-20% was achieved.

**DATA SOURCE:**

* + Reservation System (all channels)
  + Departure Control System
  + Fares & Ticketing System

**DATA SIZE & FILE TYPE:**

Approximately 5000-5500 records per day and the files are generated in CSV/Excel format

Only data from Global Distribution System (live data) comes into the system as Type-1 & Type-2 messages which needs to be parsed and processed into csv/excel format.

**TABLES:**

1. System Table
   1. Inventory
   2. Fares
   3. Scheduling
   4. Citypair details
2. Sales Table
   1. Flight summary
   2. Load Factor
   3. Reservation details
   4. Booking availability with Class(live)
3. Accounting Table
   1. Payment details
   2. Station details(live)
   3. Tax extract details
   4. Agency details(live)
4. Operations Table
   1. Reservation summary
   2. Flight by Status(live)
   3. Passenger contact details
   4. Travel agency contact details

**Team Size & Distribution:**

* Solution Architect/Project Manager (1)
* Lead (2)
* Dev-ops Eng(1)
* QA Engineers(2)
* UI Engineers(3)
* Data Scientist(2)

**Log Maintenance:**

* MongoDB
* Files that are processed
  + Accepted
  + Rejected with reason
* Error scenarios & Exception cases

**Data Pre-processing:**

Total of 16 tables were referred and finally built 6 master table for all our model building

1. System Table
2. Sales Table
3. Accounting Table
4. Operations Table

**Roles & Responsibilities:**

* Point of contact with Stakeholders
* Product Ownership
* Solution Design & Project Management
* Managing the entire team
* Project delivery & Support

**Deployment:**

* On-premises & AWS

**Outcome of the Project:**

1. Increase in sales by additional 15-20%
2. Optimal Schedule management
3. Optimal Fare management
4. Optimal Inventory management
5. Compensated the NO-SHOW rate with most accurate overbooking management
6. Reduction in opportunity cost
7. Increased business opportunity
8. Quick and Effective decision making process by all levels with better insights

**Dashboard:**

1. Management Dashboard:
2. Total Revenue by:

* Flight-no
* Day/Month/Quarterly/Yearly/Custom period
* Booking Class (1st-Class, Business, Economy)
* City Pair (Leg-wise and Combined)
* Station
* Channels
* Ticket, In-flight shopping, Merchandising, Addition service, Cargo
* Ad-hoc services (Charters, Special flights)

1. Load Factor by:

* Flight-no
* Day/Month/Quarterly/Yearly/Custom period
* Booking Class (1st-Class, Business, Economy)
* City Pair (Leg-wise and Combined)
* Station
* 30-day trend

1. Flown PAX vs No-Show
2. Flight Utilization report (Scheduled vs Actual)
3. Sales Dashboard:
4. Booking Availability
5. Bookings report by:

* Departure/Arrival Airport
* Departure month
* Fare Basis & Fare Class
* Hour
* Marketing code
* Channel
* Flight-no
* City pair

1. Booked services details
2. Reservation activity report
3. Reservation charge detail report
4. Load Factor Report

* Flight-no
* Day/Month/Quarterly/Yearly/Custom period
* Booking Class (1st-Class, Business, Economy)
* City Pair (Leg-wise and Combined)
* Station
* 30-day trend

1. Accounting Dashboard:
2. Agent detail report
3. Revenue detail report

* Flight-no
* Day/Month/Quarterly/Yearly/Custom period
* Booking Class (1st-Class, Business, Economy)
* City Pair (Leg-wise and Combined)
* Station

1. Revenue Summary report
2. Forward booking report
3. Tax extract detail report
4. Operations Dashboard:
   1. On Time Performance (OTP) report
   2. Load Factor Report

* Flight-no
* Day/Month/Quarterly/Yearly/Custom period
* Booking Class (1st-Class, Business, Economy)
* City Pair (Leg-wise and Combined)
* Station
* 30-day trend
  1. Schedule vs Actual operated flight
  2. Flown vs No-show pax report
  3. Flight Cancellation report with category (technical, weather, etc)

**Technology Stack:**

1. Database:

* SQL
* MongoDB

1. UI/UX:

* HTML, CSS, Javascript, Angular JS

1. Machine Learning:

* Python (Pandas, Matplotlib, Seaborn, Numpy, Scikit)
* Algorithms: Regression, Classification, Clustering & Time Series
* Framework: Flask

1. Visualization:

* Power BI, Excel

1. Other:

* MS Office, MS Visio, Jira, MS Project, Zoom & UML,AWS

**Project-2**

**Optimization of Operation Control Centre(OCC) using ML Model**

**PROBLEM STATEMENT:**

Airline struggles to control the cost though they are aware that their operations are not optimal. They were able to control cost very minimally due to lack of insight about their daily operations. Various factors that influences are:

* Sub-Optimal aircraft allocation
* Fuel inefficiency
* Wastage in in-flight meal
* Sub-Optimal management of IRROPS (Irregular operations)

**SOLUTION:**

With the historical data available for the past 7-years, we build an ML based model that helped to achieve reduce cost and optimize their operations which resulted in saving 5-10% of their Fixed Operating Cost. Model helped to predict the following:

* Optimal aircraft allocation
* Effective fuel management
* Optimal in-flight meal management
* Effective IRROS management

**DATA SOURCE:**

* Reservation System
* Departure Control System
* Flight Data Monitoring (FDM) system

**DATA SIZE & FILE TYPE:**

Reservation System – 5,000-5,500 records per day (CSV format)

Departure Control System – 5,000-5,500 records per day (CSV format)

FDM system – 750MB/flight/day (We take very few fields from each file)

**TABLES:**

1. System Table
   1. Scheduling
2. Sales Table
   1. Flight summary
   2. Load Factor
   3. Reservation details
3. Operations Table
   1. Flight Following Sheet
   2. Flight by Status(live)
4. Flight Data Monitoring (FDM) Table
5. Flight Data Record file

**Team Size & Distribution:**

* Solution Architect/Project Manager (1)
* Lead (2)
* Dev-ops Eng(1)
* QA Engineers(2)
* UI Engineers(3)
* Data Scientist(2)

**Log Maintenance:**

* MongoDB
* Files that are processed
  + Accepted
  + Rejected with reason
* Error scenarios & Exception cases

**Data Pre-processing:**

Total of 7 tables were referred and finally built 2 master tables for all our model building

* Commercial table
* Operations table

**Roles & Responsibilities:**

* Point of contact with Stakeholders
* Product Ownership
* Solution Design & Project Management
* Managing the entire team
* Project delivery & Support

**Deployment:**

* On-premises & AWS

**Outcome of the Project:**

Increase in passenger load and optimal usage of Aircraft

Increase in fuel efficiency

Optimal use of in-flight meals

Reduction in Fixed cost by 5-10%

**Dashboard:**

1. Management Dashboard:
2. Passenger Load Factor by:
   * + Flight-no
     + City-pair
     + Day
3. On Time Performance (OTP)
4. Aircraft Utilization rate
5. Fuel Consumption per Block-Hour & Flight-Hour
6. Operations & Commercial Dashboard:
   1. Passenger Load Factor by:
      * Flight-no
      * City-pair
      * Day
   2. On Time Performance (OTP)
   3. Aircraft Utilization rate
   4. Fuel Consumption per Block-Hour & Flight-Hour

**Technology Stack:**

1. Database:

* SQL
* MongoDB

1. UI/UX:

* HTML, CSS, Javascript, Angular JS

1. Machine Learning:

* Python (Pandas, Matplotlib, Seaborn, Numpy, Scikit)
* Algorithms: Regression, Classification, Clustering & Time Series
* Framework: Flask

1. Visualization:

* TABLEAU, Excel

1. Other:

* MS Office, MS Visio, Jira, MS Project, Zoom & UML,AWS

**Project-3**

**Optimization of Call Centre Operation using ML Model**

**PROBLEM STATEMENT:**

Airline complained that their customers are facing challenges while booking on certain days and certain time. Internally the company analysed with their capability and found that their call centre operation was not optimal and there are lot of rooms to optimize which can help for more effective and optimal solution.

**SOLUTION:**

With the help of historical data from the call centre data and from the service provider we build an ML based model that helped to achieve the following:

* Increase in call volume by 15-20% with existing resource which also increased in the sales by 5-10% from call centre POS.
* Able to identify peak, off-peak and normal period of incoming calls and fixed it
* Effective resource allocation
* Improvement in customer service and customer experience
* Able to segment the type of calls/queries which helped to train the resource on latest trends
* Call waiting and queuing timings was reduced drastically
* Individual resource performance was measured accurately and improvement was done

**DATA SOURCE:**

* Reservation System
* Departure Control System
* Flight Data Monitoring (FDM) system

**DATA SIZE & FILE TYPE:**

Call Centre System (PABX) – 1,000-1,500 records per day (CSV format)

Call Segmentation file (Internal) – 2,500-3,000 records per day (CSV format)

**TABLES:**

* PABX table
* Call Segmentation table

**Team Size & Distribution:**

* Solution Architect/Project Manager (1)
* Lead (2)
* Dev-ops Eng(1)
* QA Engineers(2)
* UI Engineers(3)
* Data Scientist(2)

**Log Maintenance:**

* MongoDB
* Files that are processed
  + Accepted
  + Rejected with reason
* Error scenarios & Exception cases

**Data Pre-processing:**

Total of 2 master tables were built for all our model building

* PABX table
* Segmentation table

**Roles & Responsibilities:**

* Point of contact with Stakeholders
* Product Ownership
* Solution Design & Project Management
* Managing the entire team
* Project delivery & Support

**Deployment:**

* On-premises & AWS

**Outcome of the Project:**

* Segmentation of call trends (peak-hour, off-peak & normal)
* Increase in efficiency (total received calls vs Served calls with SL)
* Increase in call volume and increase in sales by 5-10% from call centre POS
* Optimal resource allocation and utilization

**Dashboard:**

Overall Dashboard(applicable for all levels):

* Total Calls received in open state
* Calls served after queuing
* Calls served by agent
* Calls served in time
* Average Speed of Answer (ASA)
* Average waiting duration of abandoned calls
* Average Handling Time (AHT)
* Average Talk Time
* SL
* Efficiency
* Overall number of abandons > 5 Sec
* Hourly AVG Agents
* Overall number of abandons all included
* Rejected Calls

**Technology Stack:**

1. Database:

* SQL
* MongoDB

1. UI/UX:

* HTML, CSS, Javascript, Angular JS

1. Machine Learning:

* Python (Pandas, Matplotlib, Seaborn, Numpy, Scikit)
* Algorithms: Regression, Clustering & Time Series
* Framework: Flask

1. Visualization:

* PowerBI, Excel

1. Other:

* MS Office, Jira, MS Project, Zoom & AWS

**Project-4**

**Business Plan Model Simulation**

**PROBLEM STATEMENT:**

Airline wants to know the forecast and roadmap for the next 5-years about its operations and expansion plan. So that the board members can convince the investors for funding.

**SOLUTION:**

Complete business plan for 5-year term as been implemented with the option for the Senior Management to tune the parameters to know the exact status of the entire business at any given point of time.

**DATA SOURCE:**

* Commercial file
* Ground operations file
* Flight operations file
* Engineering operations file
* Human Resource file
* System Parameters file
* Finance file

**DATA SIZE & FILE TYPE:**

* 7 fixed input files from various department
* Calculated tables (32) with each table between 70-90 records
* All the files are in Excel format

**TABLES:**

* Commercial Table
* GroundOps Table
* FlightOps Table
* Engineering Table
* HR Table
* System Table
* Finance Table
* Network & Route Table
* Schedule Table
* Aircraft Spec Table
* General Assumptions Table

**Team Size & Distribution:**

* Solution Architect/Project Manager (1)
* Lead (2)
* Dev-ops Eng(1)
* QA Engineers(2)
* UI Engineers(3)
* Data Analyst(2)

**Log Maintenance:**

* MongoDB
* Files that are processed
  + Accepted
  + Rejected with reason
* Error scenarios & Exception cases

**Data Pre-processing:**

There is no pre-processing required for this project

**Roles & Responsibilities:**

* Point of contact with Stakeholders
* Product Ownership
* Solution Design & Project Management
* Managing the entire team
* Project delivery & Support

**Deployment:**

* On-premises & AWS

**Outcome of the Project:**

* Complete 360 degree view of the business was presented with detailed DASHBOARD for various levels
* Options for tuning the parameters for testing different scenarios
* Overall high level KPIs for the management team for timely decision making.
* Department wise KPIs with other insights for quick action
* Helped to plan the budget in effective manner

**Dashboard:**

1. Management Dashboard:
   1. Revenue report by
      1. Day/Month/Quarterly/Yearly
      2. Route
      3. Channels
   2. PAX report by
      1. Day/Month/Quarterly/Yearly
      2. Route
      3. Channels
      4. Booked vs Flown vs No-show
   3. Cost report by:
      1. Fixed Operating Cost
      2. Direct Operating Cost
      3. Indirect Operating Cost
      4. Revenue vs Cost
   4. Break-even report
   5. Aircraft Utilization report
2. Commercial Dashboard:
   1. Revenue report by:
      1. Flight-no
      2. Route (City pair)
      3. Channel
   2. Load Factor report by:
      1. Flight-no
      2. Day/Month/Quarterly/Yearly/Custom period
      3. Booking Class (1st-Class, Business, Economy)
      4. City Pair (Leg-wise and Combined)
      5. Station
3. Operations Dashboard:
   1. Flight Utilization by:
      1. Route
      2. Day/Week/Month/Year
      3. Block Hour & Flight Hour
      4. Segments
   2. Schedule report
   3. Route & Network report
4. Finance Dashboard:
   1. Revenue report
   2. Cost report
      1. Direct Operating Cost (DOC)
      2. Fixed Operating Cost(FOC)
      3. Indirect Operating Cost(IOC)
   3. Load Factor report
   4. Tax Report
   5. Aircraft Utilization report

**Technology Stack:**

1. Database:
   1. SQL
   2. MongoDB
2. UI/UX:
   1. HTML, CSS, Javascript, Angular JS
3. Visualization:
   1. PowerBI, Excel
4. Others:
   1. MS Office, Jira, MS Project, Zoom & AWS