# AIRPORT OPERATIONAL DATABASE MANAGEMENT SYSTEM
# PROJECT REPORT

- **By**

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Problem Statement: To design an Airport Operational Database Management System to streamline and optimize various operational processes at an airport, including flight schedules, air traffic control, resource allocation, etc.

Description:

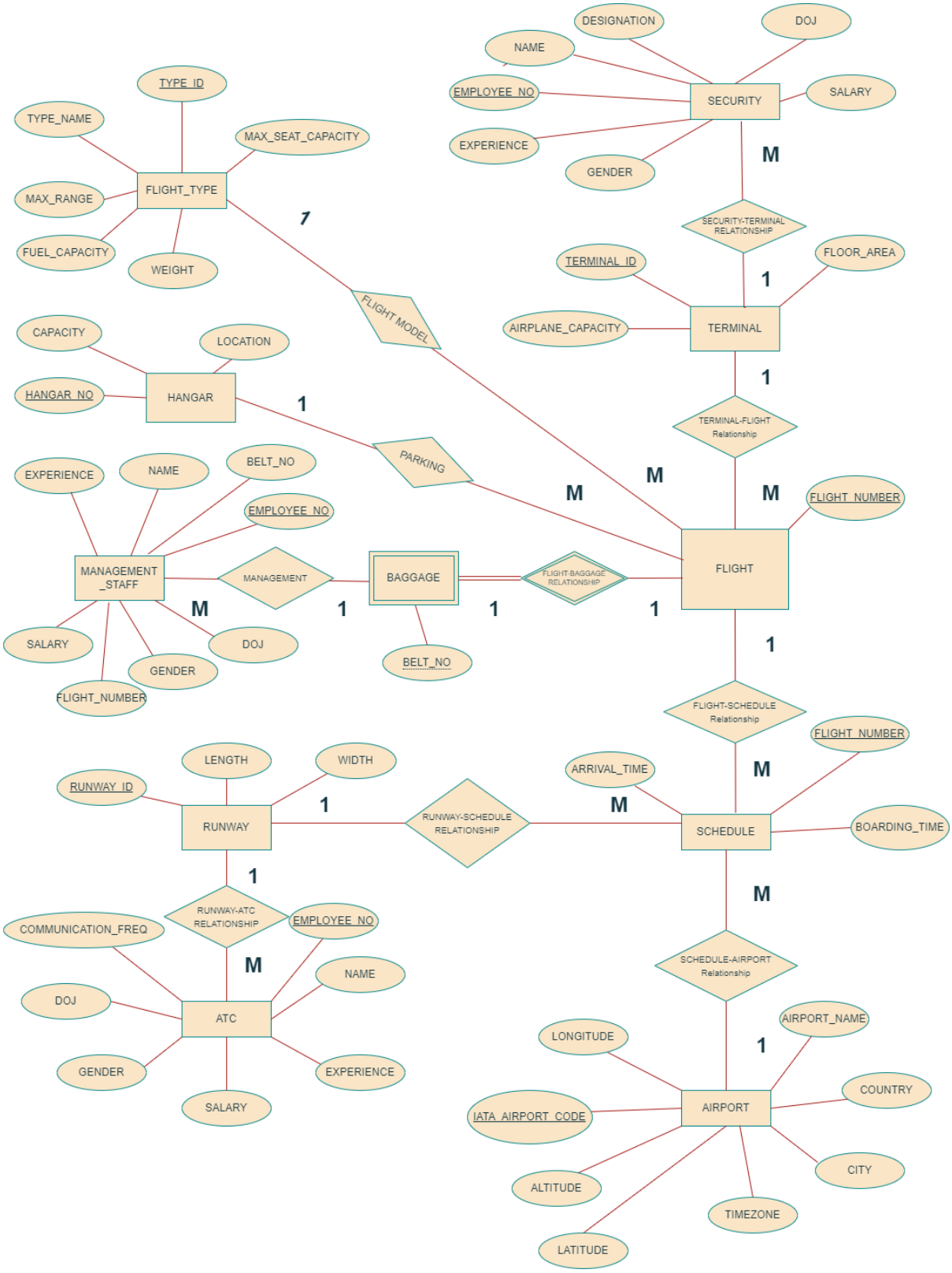
Airport Operational Database Management Systems (AODBMS) are essential for managing and coordinating various airport operations. These comprehensive software systems centralize data related to flight schedules, resource allocation, and other operational aspects. However, managing an AODBMS presents challenges such as integrating multiple systems, ensuring real-time data synchronization, and maintaining data security.

Integrating various airport systems and databases is a complex task for AODBMS. Interoperability and data consistency among these systems is crucial for accurate information management. Additionally, the dynamic nature of airport operations requires prompt updates and data synchronization. Security and data privacy are also significant concerns, as airports handle sensitive passenger information. Overcoming these challenges is crucial for the efficient functioning of AODBMS and for providing a seamless travel experience for passengers.

Database Design:

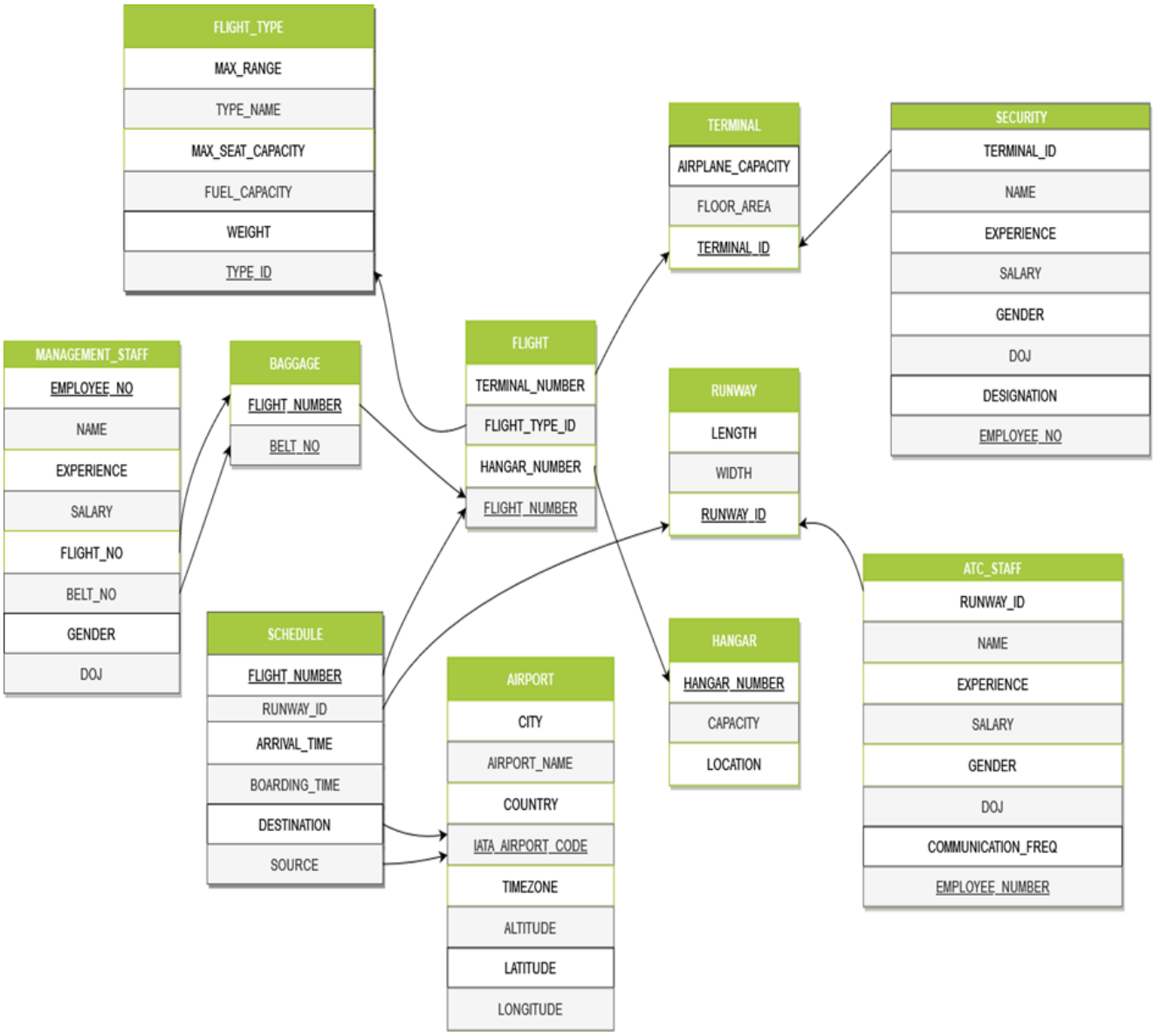
Our design involves creating a structured and efficient database schema that can effectively store and manage vast data related to airport operations. It focuses on ensuring data integrity, scalability, and performance while accommodating the complex relationships between various entities such as flights, baggage, resources, and schedules. It defines appropriate tables, establishes relationships between them, and normalizes them providing a solid foundation for the storage and retrieval of data.

# Entity-Relationship Model:



- Since *security* and *terminal* have a one-many relationship we can combine the security table and the *security-terminal relation* table resulting in two tables, *security* and *terminal*.
- Since *schedule* and *airport* have a many-one relationship and *schedule* also has a many-one relationship with *runway* hence we can combine the *schedule* table with the *schedule-airport relationship* table and *runway-schedule relationship* resulting in three tables *runway*, *schedule*, and *airport*.
- Since *runway* and *ATC* have a one-many relationship we can combine the *ATC* table with the *runway-ATC relationship* table resulting in two tables *ATC* and *runway*.
- Since *baggage* is a weak entity set, it takes the primary key of the *flight* table and forms a composite primary key (flight_number, belt_no).
- Since *baggage* and *management_staff* have a one-many relationship we can combine the *management_staff* table and the *management relation* table resulting in two tables, *baggage* and *management_staff* table.
- As the *flight* table has many-one relationships with *hangar*, *flight_type*, and *terminal*, we can combine the relationships table between them with the *flight* table to give four tables *flight*, *flight_type*, *hangar*, and *terminal*.

# TABLE SCHEMA:



ENTITY SET:

1. *TERMINAL: The terminal table provides the relevant details regarding the terminals at an airport.*
   Attributes: TERMINAL_ID, FLOOR_AREA, AIRPLANE_CAPACITY.
   Candidate/Primary Key: TERMINAL_ID.
   FOREIGN KEYS: NONE
   Highest Normal Form: BCNF. All functional dependencies are determined by the primary/candidate key.

2. *FLIGHT_TYPE: This entity describes the type and build of various types of aircraft.*
   Attributes: TYPE_ID, TYPE_NAME , MAX_SEAT_CAPACITY, FUEL_CAPACITY, WEIGHT, MAX_RANGE .
   Candidate/Primary Key: TYPE_ID.
   FOREIGN KEYS: NONE
   Highest Normal Form: BCNF. All functional dependencies are determined by the primary/candidate key.

3. *HANGAR: Gives information on the location and capacity of a particular hangar to handle aircraft.*
   Attributes: HANGAR_NUMBER, CAPACITY, LOCATION
   Candidate/Primary Key: HANGAR_NUMBER.
   FOREIGN KEYS: NONE
   Highest Normal Form: BCNF. All functional dependencies are determined by the primary/candidate key.

4. *FLIGHT: This entity gives details regarding the flight numbers of various flights and the terminals each flight belongs to as well as its hangar number.*
   Attributes: FLIGHT_NUMBER, FLIGHT_TYPE_ID, HANGAR_NUMBER, TERMINAL_ID
   Candidate/Primary Key: FLIGHT_NUMBER.
   FOREIGN KEYS:
   FLIGHT_TYPE_ID->FLIGHT_TYPE(FLIGHT_TYPE_ID),
   HANGAR_NUMBER->HANGAR(HANGAR_NUMBER),
   TERMINAL_ID->TERMINAL(TERMINAL_ID).
   Highest Normal Form: BCNF. All functional dependencies are determined by the primary/candidate key.

5. *BAGGAGE: Provides details of the baggage that has arrived for collection in an airport upon arrival.*
   Attributes: FLIGHT_NUMBER, BELT_NO
   Candidate/Primary Key: (FLIGHT_NUMBER, BELT_NO).
   FOREIGN KEYS: NONE
   Highest Normal Form: BCNF. No partial dependencies are present however there exist transitive dependencies.

6. *MANAGEMENT_STAFF: This entity contains information regarding all the staff responsible for managing baggage and other important groundwork.*
   Attributes: EMPLOYEE_NO, NAME, EXPERIENCE, SALARY, GENDER, DOJ, BELT_NO, FLIGHT_NO
   Candidate/Primary Key: EMPLOYEE_NO
   FOREIGN KEYS: NONE

Highest Normal Form: BCNF. All functional dependencies are determined by the primary/candidate key with no partial and transitive dependencies.

7. *RUNWAY: Provides details of the dimensions of the runway.*
   Attributes: RUNWAY_ID, WIDTH, LENGTH
   Candidate/Primary Key: RUNWAY_ID
   FOREIGN KEYS: NONE
   Highest Normal Form: BCNF. All functional dependencies are determined by the primary/candidate key with no partial and transitive dependencies.

8. *AIRPORT: Contains data regarding several other destination airports.*
   Attributes: IATA_AIRPORT_CODE, AIRPORT_NAME, COUNTRY, CITY, TIMEZONE, ALTITUDE, LATITUDE, LONGITUDE
   Candidate/Primary Key: IATA_AIRPORT_CODE
   FOREIGN KEYS: NONE
   Highest Normal Form: BCNF. All functional dependencies are determined by the primary/candidate key with no partial and transitive dependencies.

9. *SCHEDULE: This entity contains details regarding the schedule of several flights such as their source and destinations, arrival and departure time, etc.*
   Attributes: FLIGHT_NUMBER, SOURCE , DESTINATION, BOARDING_TIME, ARRIVAL_TIME , RUNWAY_ID
   Candidate/Primary Key: FLIGHT_NUMBER.
   FOREIGN KEYS:
   FLIGHT_NUMBER->FLIGHT(FLIGHT_NUMBER),
   SOURCE->AIRPORT(IATA_AIRPORT_CODE),

DESTINATION->AIRPORT(IATA_AIRPORT_CODE)
Highest Normal Form: BCNF. All functional dependencies are determined by the primary/candidate key with no partial and transitive dependencies.

10. *SECURITY: Provides details about the security staff in and around the airport.*
Attributes: EMPLOYEE_NO, NAME, EXPERIENCE, SALARY, GENDER, DOJ, DESIGNATION, TERMINAL_ID
Candidate/Primary Key: EMPLOYEE_NO
FOREIGN KEYS:
TERMINAL_ID->TERMINAL(TERMINAL_ID)
Highest Normal Form: BCNF. All functional dependencies are determined by the primary/candidate key with no partial and transitive dependencies.

11. *ATC_STAFF: Contains details of all the air traffic control staff, managing the runway and air traffic.*
Attributes: EMPLOYEE_NO, NAME, EXPERIENCE, SALARY, GENDER, DOJ, COMMUNICATION_FREQ, RUNWAY_ID
Candidate/Primary Key: EMPLOYEE_NO
FOREIGN KEYS:
RUNWAY_ID->RUNWAY(RUNWAY_ID)
Highest Normal Form: BCNF. All functional dependencies are determined by the primary/candidate key with no partial and transitive dependencies.

## RELATIONS (TABLES):

- TERMINAL

| | TERMINAL_ID | FLOOR_AREA | AIRPLANE_CAPACITY |
|---|---|---|---|
| 1 | 1 | 1200 | 12 |
| 2 | 2 | 1300 | 16 |
| 3 | 3 | 1500 | 15 |

- FLIGHT_TYPE

| | TYPE_ID | TYPE_NAME | MAX_SEAT_CAPACITY | FUEL_CAPACITY | WEIGHT | MAX_RANGE |
|---|---|---|---|---|---|---|
| 1 | 1 | BOEING 737 | 220 | 94770 | 78130 | 7040 |
| 2 | 2 | BOEING 767 | 180 | 90700 | 80100 | 10400 |
| 3 | 3 | AIRBUS A220 | 160 | 21500 | 54400 | 6290 |
| 4 | 4 | AIRBUS A320 | 170 | 27200 | 58900 | 6200 |
| 5 | 5 | AIRBUS A330 | 405 | 139100 | 158700 | 11720 |
| 6 | 6 | BOEING 777 | 380 | 181300 | 134800 | 15000 |
| 7 | 7 | BOEING 787 DREAMLINER | 300 | 126200 | 119900 | 13500 |
| 8 | 8 | DOUGLAS DC8 | 270 | 88500 | 54300 | 4800 |
| 9 | 9 | AIRBUS A300 | 230 | 68000 | 127000 | 7500 |
| 10 | 10 | AIRBUS A310 | 200 | 61000 | 127000 | 8000 |

- HANGAR

| | HANGAR_NUMBER | CAPACITY | LOCATION |
|---|---|---|---|
| 1 | 1 | 25 | SECTOR 1 |
| 2 | 2 | 27 | SECTOR 1 |
| 3 | 3 | 31 | SECTOR 2 |
| 4 | 4 | 18 | SECTOR 3 |
| 5 | 5 | 15 | SECTOR 3 |

- FLIGHT

| | FLIGHT_NUMBER | FLIGHT_TYPE_ID | HANGAR_NUMBER | TERMINAL_ID |
|---|---|---|---|---|
| 1 | 101 | 1 | 1 | 3 |
| 2 | 102 | 2 | 2 | 3 |
| 3 | 103 | 1 | 3 | 2 |
| 4 | 104 | 7 | 4 | 3 |
| 5 | 105 | 9 | 5 | 1 |
| 6 | 106 | 4 | 2 | 2 |
| 7 | 107 | 6 | 4 | 3 |
| 8 | 108 | 6 | 5 | 2 |
| 9 | 109 | 5 | 3 | 1 |
| 10 | 110 | 8 | 1 | 1 |

- BAGGAGE

| | FLIGHT_NUMBER | BELT_NO |
|---|---|---|
| 1 | 101 | 1 |
| 2 | 102 | 2 |
| 3 | 103 | 3 |
| 4 | 104 | 4 |
| 5 | 105 | 5 |
| 6 | 106 | 6 |
| 7 | 107 | 7 |
| 8 | 108 | 8 |
| 9 | 109 | 9 |
| 10 | 110 | 10 |

- MANAGEMENT_STAFF

| | EMPLOYEE_NO | NAME | EXPERIENCE | SALARY | GENDER | DOJ | BELT_NO | FLIGHT_NO |
|---|---|---|---|---|---|---|---|---|
| 1 | 10101 | SHREYAS | 1 | 10000 | M | 12-JAN-22 | 1 | 101 |
| 2 | 10102 | ROHITH | 3 | 10000 | M | 12-JAN-20 | 2 | 102 |
| 3 | 10103 | SHRAVAN | 18 | 50000 | M | 22-JUL-05 | 3 | 103 |
| 4 | 10104 | KUMAR | 18 | 50000 | M | 30-MAR-05 | 4 | 104 |
| 5 | 10105 | RAM | 21 | 155000 | M | 02-APR-02 | 5 | 105 |
| 6 | 10106 | SITA | 5 | 30000 | F | 24-JAN-18 | 6 | 106 |
| 7 | 10107 | DIVYA | 2 | 10000 | F | 28-FEB-21 | 7 | 107 |
| 8 | 10108 | ANAND | 3 | 20000 | M | 30-MAY-20 | 8 | 108 |
| 9 | 10109 | AMAN | 3 | 20000 | M | 22-JUN-20 | 9 | 109 |
| 10 | 10110 | ROHAN | 2 | 10000 | M | 11-JAN-21 | 10 | 110 |

- RUNWAY

| | RUNWAY_ID | WIDTH | LENGTH |
|---|---|---|---|
| 1 | 1 | 45 | 4000 |
| 2 | 2 | 45 | 3500 |
| 3 | 3 | 60 | 3700 |

- AIRPORT

| | IATA_AIRPORT_CODE | AIRPORT_NAME | COUNTRY | CITY | TIMEZONE | ALTITUDE | LATITUDE | LONGITUDE |
|---|---|---|---|---|---|---|---|---|
| 1 | MCT | MUSCAT INTERNATIONAL AIRPORT | OMAN | MUSCAT | GST | 15 | 23.6017 | 58.29 |
| 2 | DXB | DUBAI INTERNATIONAL AIRPORT | UAE | DUBAI | GST | 19 | 25.2531 | 55.3656 |
| 3 | HYD | RAJIV GANDHI INTERNATIONAL AIRPORT | INDIA | HYDERABAD | IST | 617 | 17.2403 | 78.4294 |
| 4 | MAA | CHENNAI INTERNATIONAL AIRPORT | INDIA | CHENNAI | IST | 16 | 12.9941 | 80.1709 |
| 5 | COK | COCHIN INTERNATIONAL AIRPORT | INDIA | COCHI | IST | 9 | 10.1518 | 76.393 |
| 6 | TRV | THIRUVANANTHAPURAM INTERNATIONAL AIRPORT | INDIA | THIRUVANANTHAPURAM | IST | 3 | 8.4834 | 76.9198 |
| 7 | BOM | CHHATRAPATI SHIVAJI MAHARAJ INTERNATIONAL AIRPORT | INDIA | MUMBAI | IST | 11 | 19.0902 | 72.8628 |
| 8 | SIN | SINGAPORE CHANGI AIRPORT | SINGAPORE | CHANGI | SGT | 6 | 1.3545 | 101.9886 |

- SCHEDULE

| | FLIGHT_NUMBER | SOURCE | DESTINATION | BOARDING_TIME | ARRIVAL_TIME | RUNWAY_ID |
|---|---|---|---|---|---|---|
| 1 | 101 | HYD | DXB | 15:00 | 19:00 | 3 |
| 2 | 102 | HYD | MCT | 05:00 | 09:00 | 3 |
| 3 | 103 | DXB | HYD | 10:00 | 14:00 | 2 |
| 4 | 104 | BOM | HYD | 21:00 | 22:30 | 1 |
| 5 | 105 | MAA | HYD | 01:00 | 02:30 | 2 |
| 6 | 106 | HYD | SIN | 13:00 | 17:40 | 2 |
| 7 | 107 | COK | HYD | 11:00 | 12:25 | 1 |
| 8 | 108 | HYD | TRV | 10:20 | 11:50 | 2 |
| 9 | 109 | HYD | BOM | 12:00 | 13:20 | 1 |
| 10 | 110 | SIN | HYD | 18:00 | 22:40 | 3 |

- SECURITY_STAFF

| | EMPLOYEE_NO | NAME | EXPERIENCE | SALARY | GENDER | DOJ | DESIGNATION | TERMINAL_ID |
|---|---|---|---|---|---|---|---|---|
| 1 | 10201 | SHREYAS | 1 | 10000 | M | 12-JAN-22 | HEAD SECURITY | 1 |
| 2 | 10202 | ROHITH | 3 | 10000 | M | 12-JAN-20 | ASSISTANT SECURITY | 1 |
| 3 | 10203 | MARUTI | 18 | 50000 | M | 22-JUL-05 | OFFICER | 3 |
| 4 | 10204 | SHIVA | 18 | 50000 | M | 30-MAR-05 | OFFICER | 2 |
| 5 | 10205 | RAMN | 21 | 155000 | M | 02-APR-02 | ASSISTANT SECURITY | 3 |
| 6 | 10206 | LAKSHMI | 5 | 30000 | F | 24-JAN-18 | OFFICER | 2 |
| 7 | 10207 | DEVI | 2 | 10000 | F | 28-FEB-21 | OFFICER | 1 |
| 8 | 10208 | LAXMAN | 3 | 20000 | M | 30-MAY-20 | OFFICER | 3 |
| 9 | 10209 | ARON | 3 | 20000 | M | 22-JUN-20 | OFFICER | 3 |
| 10 | 10210 | RAHUL | 2 | 10000 | M | 11-JAN-21 | OFFICER | 2 |

- ATC_STAFF

| | EMPLOYEE_NO | NAME | EXPERIENCE | SALARY | GENDER | DOJ | COMMUNICATION_FREQ | RUNWAY_ID |
|---|---|---|---|---|---|---|---|---|
| 1 | 10301 | SHREYAS | 1 | 10000 | M | 12-JAN-22 | 120 | 1 |
| 2 | 10302 | ROHITH | 3 | 10000 | M | 12-JAN-20 | 130 | 1 |
| 3 | 10303 | RUDRA | 18 | 50000 | M | 22-JUL-05 | 122 | 3 |
| 4 | 10304 | RAJAT | 18 | 50000 | M | 30-MAR-05 | 134 | 2 |
| 5 | 10305 | KRISHNA | 21 | 155000 | M | 02-APR-02 | 128 | 3 |
| 6 | 10306 | DEEPTI | 5 | 30000 | F | 24-JAN-18 | 131 | 2 |
| 7 | 10307 | DHRITI | 2 | 10000 | F | 28-FEB-21 | 132 | 1 |
| 8 | 10308 | BALRAM | 3 | 20000 | M | 30-MAY-20 | 133 | 3 |
| 9 | 10309 | BHARAT | 3 | 20000 | M | 22-JUN-20 | 125 | 3 |
| 10 | 10310 | ARJUN | 2 | 10000 | M | 11-JAN-21 | 124 | 2 |

(*Note: All values inserted are for demonstration purposes only.)*

## CONCLUSION:

The Airport Operational Database Management System (AODBMS) optimizes airport operations and enhances efficiency. It integrates systems, facilitates coordination, and improves passenger satisfaction. Implementing an AODBMS brings benefits such as improved communication, enhanced safety, increased efficiency, and cost reduction. Successful implementation requires planning, training, and maintenance. The AODBMS is essential for modern airports to stay competitive in the industry.