Problem Statement/Description:

AirNova is a prominent airline providing domestic and international flights, known for its commitment to efficiency, reliability, and customer satisfaction. With a growing fleet of aircraft and increasing passenger demand, AirNova requires a robust, scalable, and intuitive web-based Flight Management System (FMS) to streamline its operational, administrative, and customer-facing processes.

As the Lead Software Engineer, your task is to design and implement an integrated FMS that effectively manages the following core functionalities:

- *Aircraft Management: Each aircraft in AirNova's fleet is uniquely identified by a tail number and includes details such as aircraft model, total seating capacity, range, current location, and maintenance records. The system must track the availability and maintenance schedules of each aircraft.*
- *Crew Management: Pilots and flight attendants must be registered with unique staff IDs, storing details such as first name, last name, contact information, certifications, qualifications, and availability. The system must ensure compliance with aviation regulations, including maximum flight hours per crew member per period.*
- *Flight Scheduling: The FMS must allow operations managers to schedule flights by assigning aircraft and crew members based on availability, qualifications, and route requirements. Each flight must have a designated flight number, departure and arrival airports, scheduled departure and arrival times, and assigned aircraft and crew.*
- *Passenger Services: Passengers should be able to create accounts, search for flights, book tickets, modify existing reservations, and cancel bookings. The system will send automatic notifications and confirmation emails to passengers upon successful booking or changes to their itinerary.*
- *Operational Dashboards: Crew members must be able to sign-in and view their upcoming flight schedules, including detailed flight information. Ground operations staff need access to real-time flight information to manage gate assignments, boarding procedures, and baggage handling efficiently.*
- *Customer Portal: Passengers must be able to log in to view flight details, status updates, and manage their travel itineraries. The system must facilitate clear communication regarding flight delays, cancellations, gate changes, or other relevant updates.*
- *Regulatory Compliance and Constraints: The system must enforce regulatory constraints, such as limits on flight hours for pilots and crew, aircraft maintenance intervals, and passenger booking restrictions.*

The overall objective is to develop an integrated, user-friendly FMS for AirNova that enhances operational efficiency, optimizes resource utilization, improves passenger satisfaction, and complies with industry regulations and safety standards.

Functional Requirements for AirNova Flight Management System

Aircraft Management

1. *The system shall allow administrators to register new aircraft with unique tail numbers.*
2. *The system shall store aircraft details including model, seating capacity, range, and current location.*
3. *The system shall maintain aircraft maintenance records and schedules.*
4. *The system shall track real-time aircraft availability status.*
5. *The system shall generate alerts for upcoming aircraft maintenance requirements.*

Crew Management

6. *The system shall allow registration of pilots and flight attendants with unique staff IDs.*
7. *The system shall store crew details including name, contact information, certifications, and qualifications.*
8. *The system shall track crew availability and flight hour accumulation.*
9. *The system shall enforce maximum flight hour limits for crew members based on regulatory requirements.*
10. *The system shall notify crew members of their assigned flights.*

Flight Scheduling

11. *The system shall allow operations managers to create and manage flight schedules.*
12. *The system shall assign unique flight numbers to each scheduled flight.*
13. *The system shall manage departure and arrival airports, dates, and times for each flight.*
14. *The system shall allow assignment of aircraft and crew to flights based on availability and qualifications.*
15. *The system shall prevent scheduling conflicts for both aircraft and crew members.*
16. *The system shall provide warnings when assigning crew members near their maximum flight hour limits.*

Passenger Services

17. *The system shall allow passengers to create and manage user accounts.*
18. *The system shall provide flight search functionality based on origin, destination, date, and other filters.*
19. *The system shall enable passengers to book tickets for available flights.*
20. *The system shall allow passengers to select seats on their booked flights.*
21. *The system shall permit passengers to modify their existing reservations.*
22. *The system shall enable passengers to cancel bookings and process refunds according to cancellation policies.*
23. *The system shall automatically send booking confirmations and itinerary updates to passengers via email.*

Operational Dashboards

24. *The system shall provide crew members with personalized dashboards displaying their flight schedules.*
25. *The system shall display detailed flight information for crew members including routes and aircraft details.*
26. *The system shall provide ground operations staff with real-time flight status information.*
27. *The system shall facilitate management of gate assignments and boarding procedures.*
28. *The system shall support baggage handling operations with relevant flight information.*

Customer Portal

29. *The system shall provide a secure login mechanism for passengers to access their accounts.*
30. *The system shall display passenger itineraries with complete flight details.*
31. *The system shall provide real-time flight status updates including delays and gate changes.*
32. *The system shall notify passengers of any changes to their flight schedule via the portal and email.*
33. *The system shall allow passengers to download and print boarding passes.*

Regulatory Compliance

34. *The system shall enforce pilot flight hour limitations according to aviation regulations.*
35. *The system shall ensure aircraft are not scheduled during their maintenance periods.*
36. *The system shall maintain audit logs for regulatory compliance purposes.*
37. *The system shall generate reports required by aviation authorities.*

Administration

38. *The system shall provide administrative tools to manage user access and permissions.*
39. *The system shall allow administrators to configure system parameters and business rules.*
40. *The system shall generate operational reports for management decision-making.*