SMART INDIA HACKATHON 2024

- **Problem Statement ID : 1711**
- **Problem Statement Title : Enhancing Rail Madad with AI-powered Complaint Management**
- **Theme - Smart Automation**
- **PS Category- Software**
- **Team ID : 48148**
- **Team Name : Neuratech**

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Transforming Rail Madad: AI-Powered Smart Complaint Management

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- **Proposed Solution (Describe your Idea/Solution/Prototype)**

Solution

Automated Categorization, Prioritization & Smart Routing

A **CNN model** processes complaint text and images, extracting features to classify, prioritize, and route complaints.

Predicting Recurring Issue

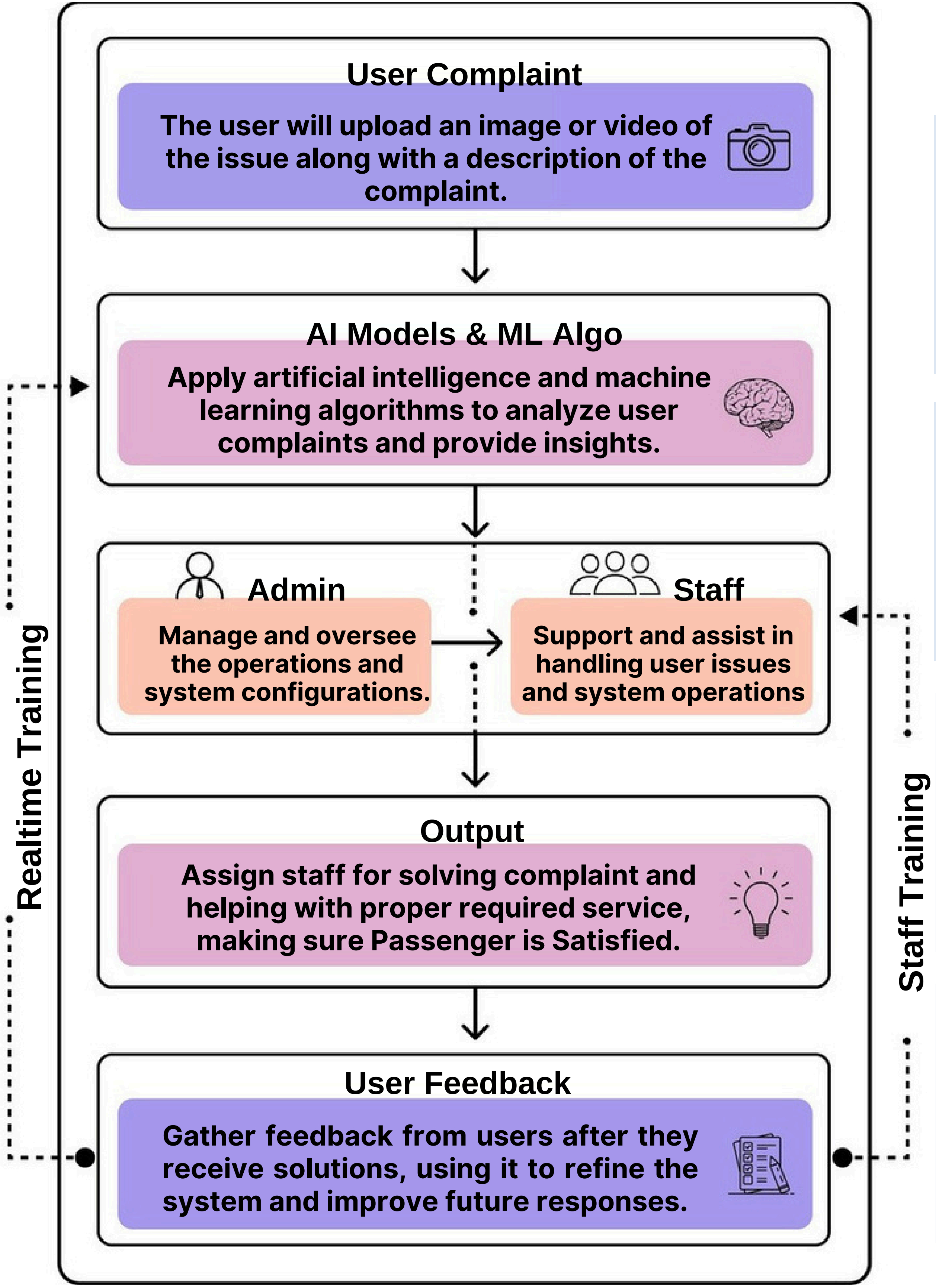
An **LSTM model** analyzes historical complaint data to detect patterns, predicting recurring issues and allowing proactive maintenance. Helps in preventing problems before they become widespread

API - Integration with Rail Madad

Creating **APIs** to connect the **AI system** with **Rail Madad**, enabling seamless data exchange. This ensures real-time updates and automated workflows across the complaint management system.

Sentiment Analysis - Feedback Management

Sentiment analysis uses **NLP models** to assess emotional tone of complaints, urgent responses to **negative feedback**. Improves customer satisfaction by addressing critical issues faster.



User Complaint

The user will upload an image or video of the issue along with a description of the complaint.

AI Models & ML Algo

Apply artificial intelligence and machine learning algorithms to analyze user complaints and provide insights.

Admin

Manage and oversee the operations and system configurations.

Staff

Support and assist in handling user issues and system operations

Output

Assign staff for solving complaint and helping with proper required service, making sure Passenger is Satisfied.

User Feedback

Gather feedback from users after they receive solutions, using it to refine the system and improve future responses.

Uniqueness

Complaint Source Integration

Aggregates complaints from diverse sources like **social media** and **news** into one system, automatically categorizing and routing them for efficient handling.

Cross-Department Collaboration

Facilitates collaboration by allowing shared access to complaints, creating a dedicated space for departments to work together on **multi-category issues**.

Complaint Recommendation

When users submit a complaint, the system shows similar **past complaints** and their **resolutions**. This helps users see how **similar issues** were handled and potentially resolve their concerns faster

Emergency Live Video Complaint/SOS

Introduces **real-time** video-based complaint reporting for emergencies, enabling **instant verification and prioritization**. Adds a new level of immediacy to critical situations.

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TECHNICAL APPROACH

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Frontend

React for admin website and Flutter for user and staff applications

Backend

Flask for building APIs and handling logic and Python for the server side solutions

Machine Learning

scikit-learn for machine learning tasks and TensorFlow for convolutional neural networks

Preprocessing

NLTK for text preprocessing & OpenCV for image & video preprocessing

Text Extraction

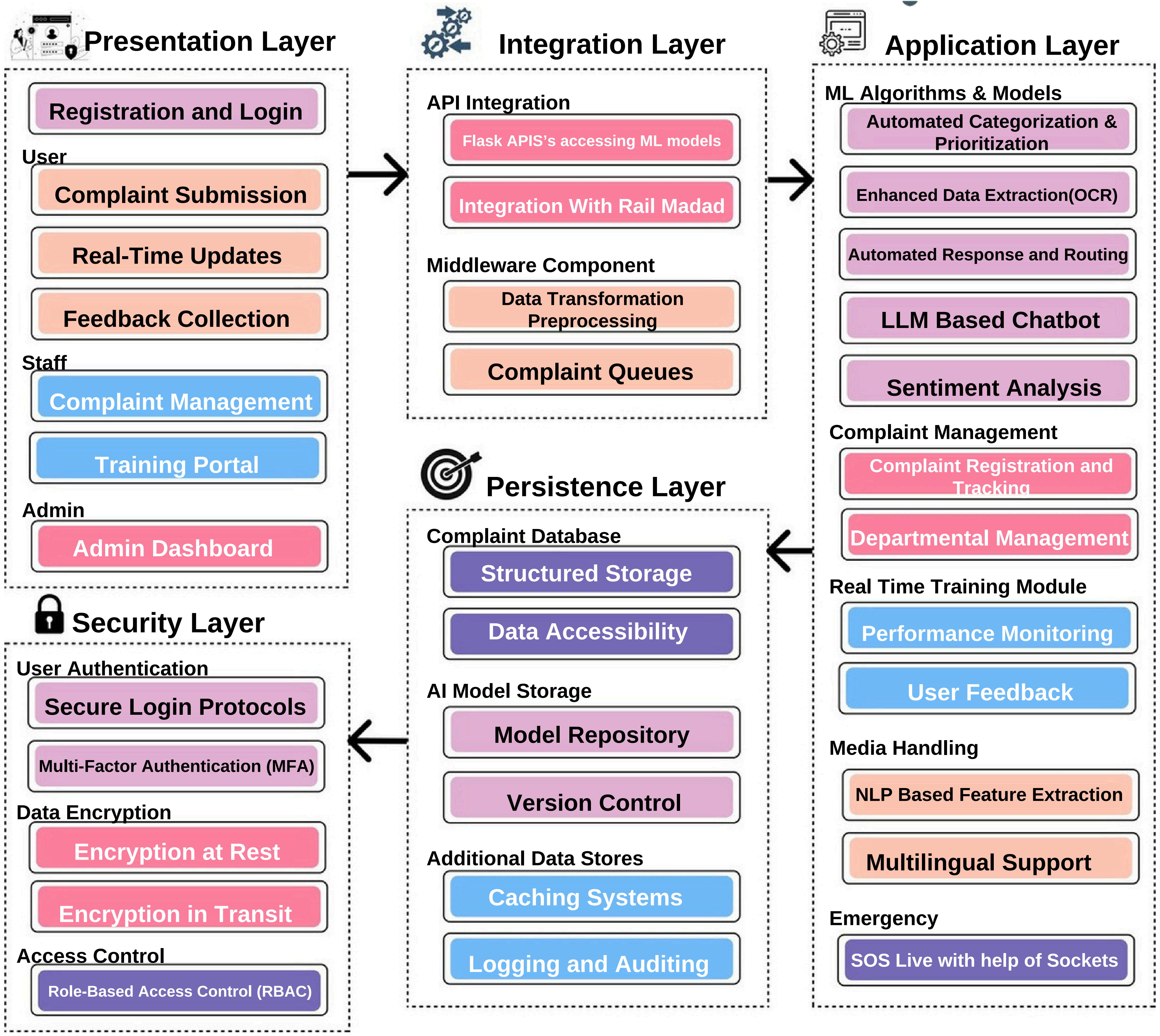
Optical Character Recognition for Text Extraction

Visualization

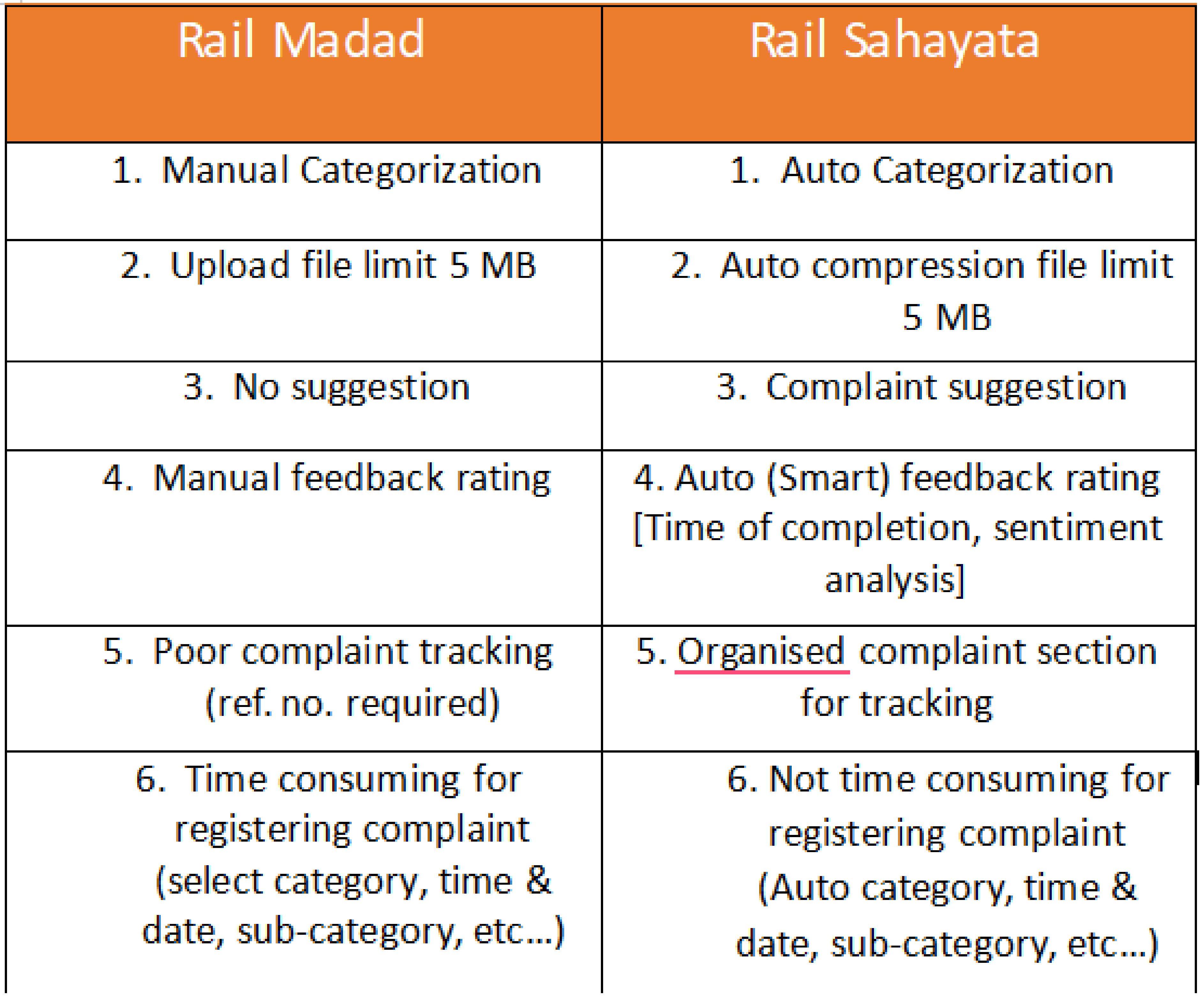
Matplotlib for Model Visualization & Chartjs for Analytics

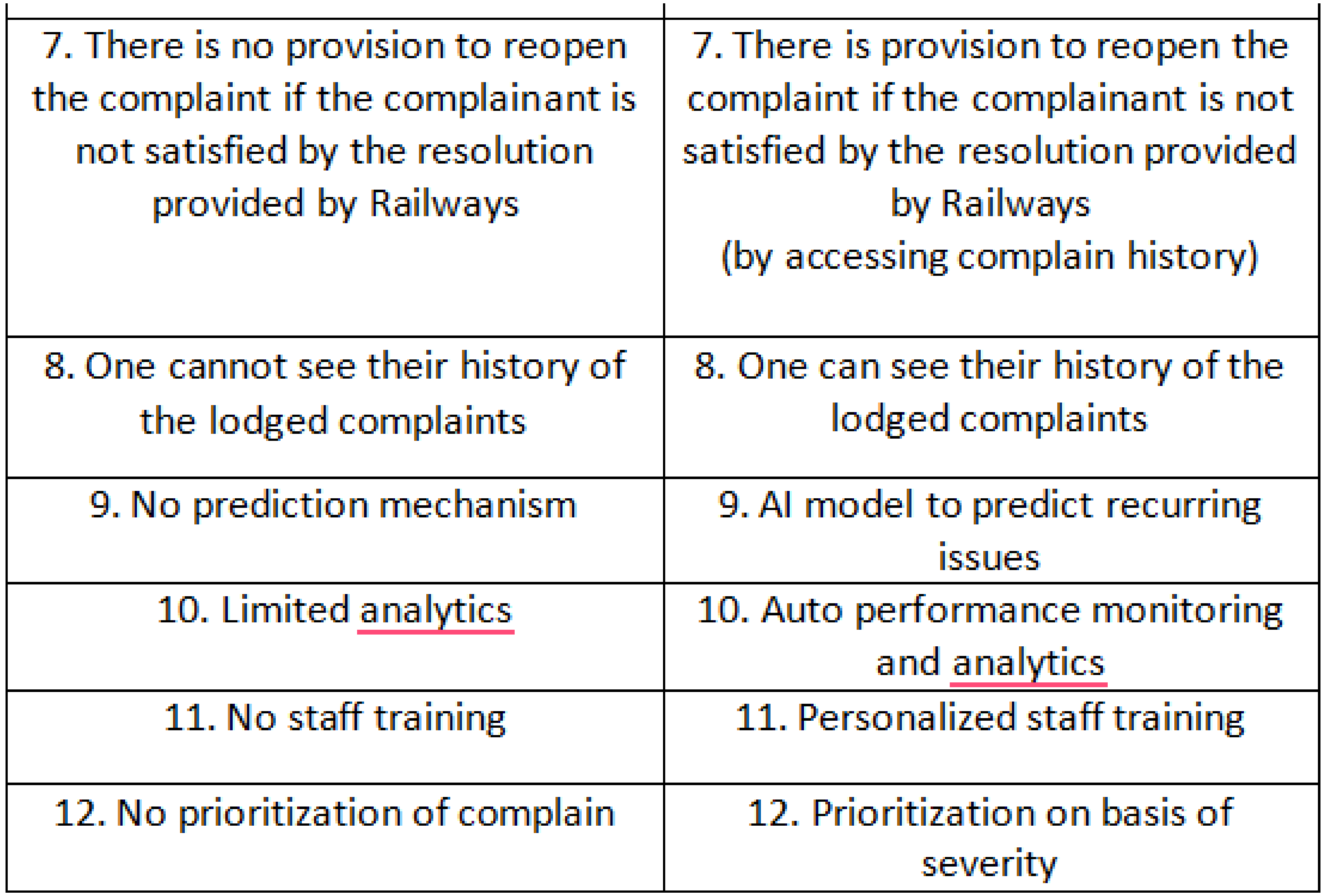
Database

Realtime updates, Auth & Storage



Rail Madad VS Rail Sahayta





Rail Madad	Rail Sahayata
1. Manual Categorization	1. Auto Categorization
2. Upload file limit 5 MB	2. Auto compression file limit 5 MB
3. No suggestion	3. Complaint suggestion
4. Manual feedback rating	4. Auto (Smart) feedback rating [Time of completion, sentiment analysis]
5. Poor complaint tracking (ref. no. required)	5. Organised complaint section for tracking
6. Time consuming for registering complaint (select category, time & date, sub-category, etc…)	6. Not time consuming for registering complaint (Auto category, time & date, sub-category, etc…)
7. There is no provision to reopen the complaint if the complainant is not satisfied by the resolution provided by Railways	7. There is provision to reopen the complaint if the complainant is not satisfied by the resolution provided by Railways (by accessing complain history)
8. One cannot see their history of the lodged complaints	8. One can see their history of the lodged complaints
9. No prediction mechanism	9. AI model to predict recurring issues
10. Limited analytics	10. Auto performance monitoring and analytics
11. No staff training	11. Personalized staff training
12. No prioritization of complain	12. Prioritization on basis of severity

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API Architecture

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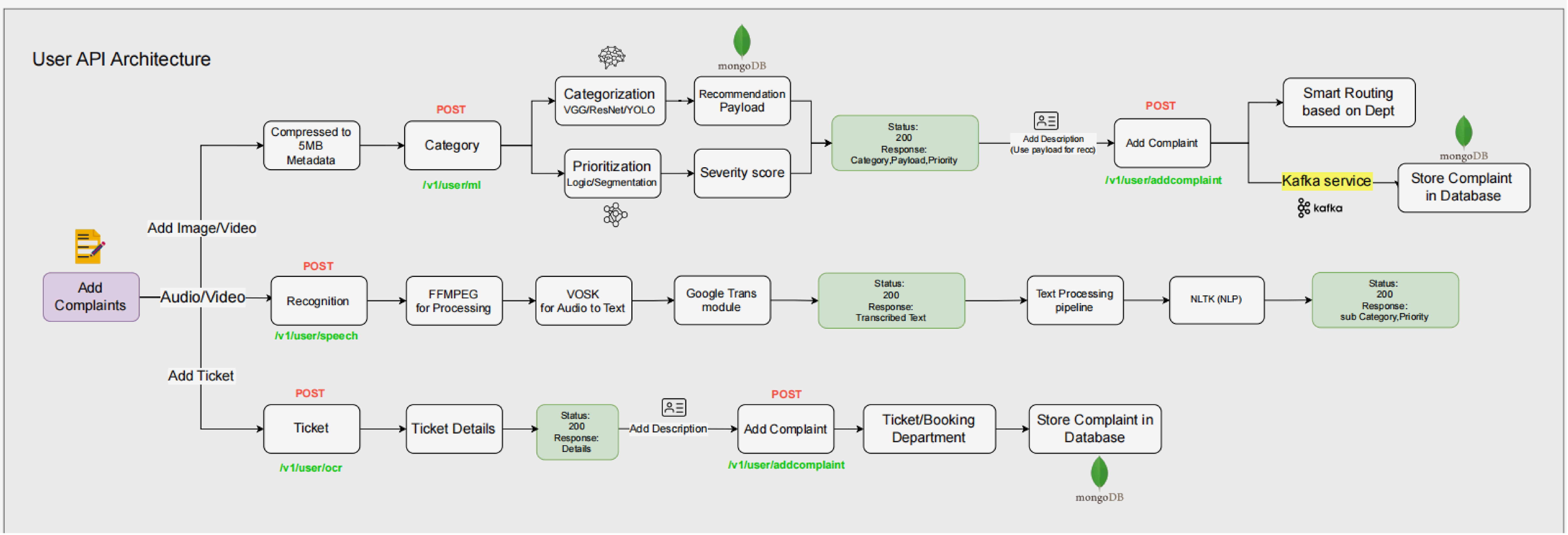


User API Architecture

Add Complaints

Add Image/Video

Compressed to 5MB Metadata

POST

Category

/v1/user/ml

Categorization VGG/ResNet/YOLO

Prioritization Logic/Segmentation

mongoDB

Recommendation Payload

Severity score

Status: 200 Response: Category,Payload,Priority

Add Description (Use payload for reco)

POST

Add Complaint

/v1/user/addcomplaint

Smart Routing based on Dept

Kafka service

kafka

mongoDB

Store Complaint in Database

Audio/Video

POST

Recognition

/v1/user/speech

FFMPEG for Processing

VOSK for Audio to Text

Google Trans module

Status: 200 Response: Transcribed Text

Text Processing pipeline

NLTK (NLP)

Status: 200 Response: sub Category,Priority

Add Ticket

POST

Ticket

/v1/user/ocr

Ticket Details

Status: 200 Response: Details

Add Description

POST

Add Complaint

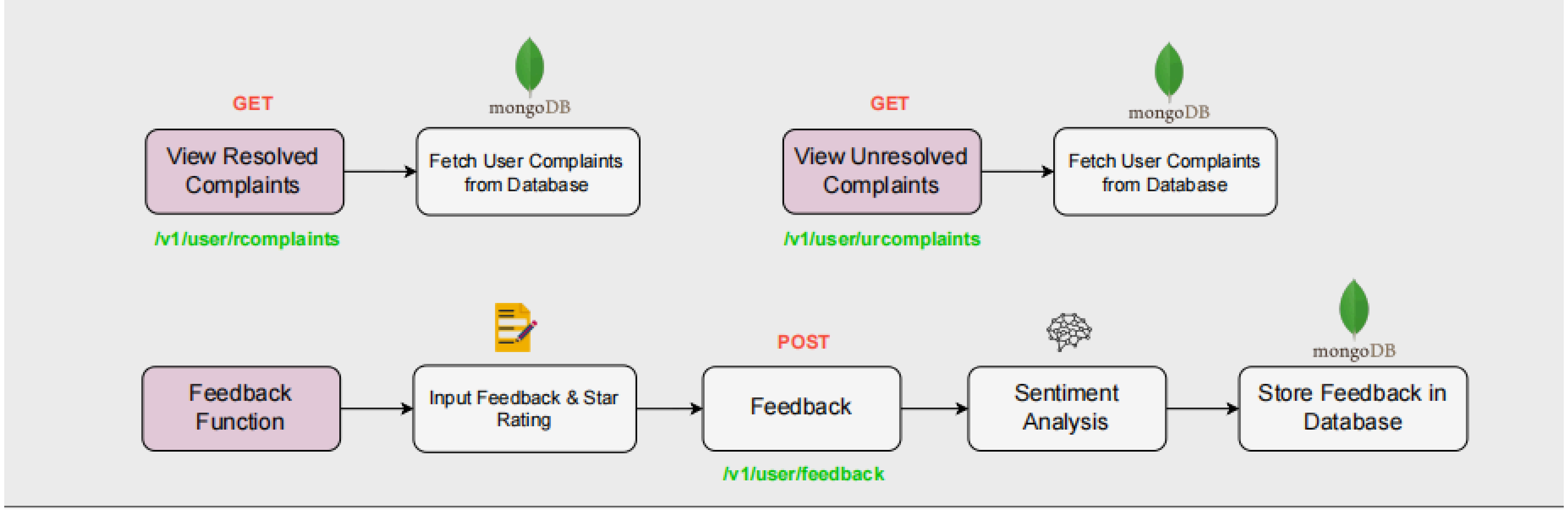
/v1/user/addcomplaint

Ticket/Booking Department

Store Complaint in Database

mongoDB

API Architecture



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API Architecture

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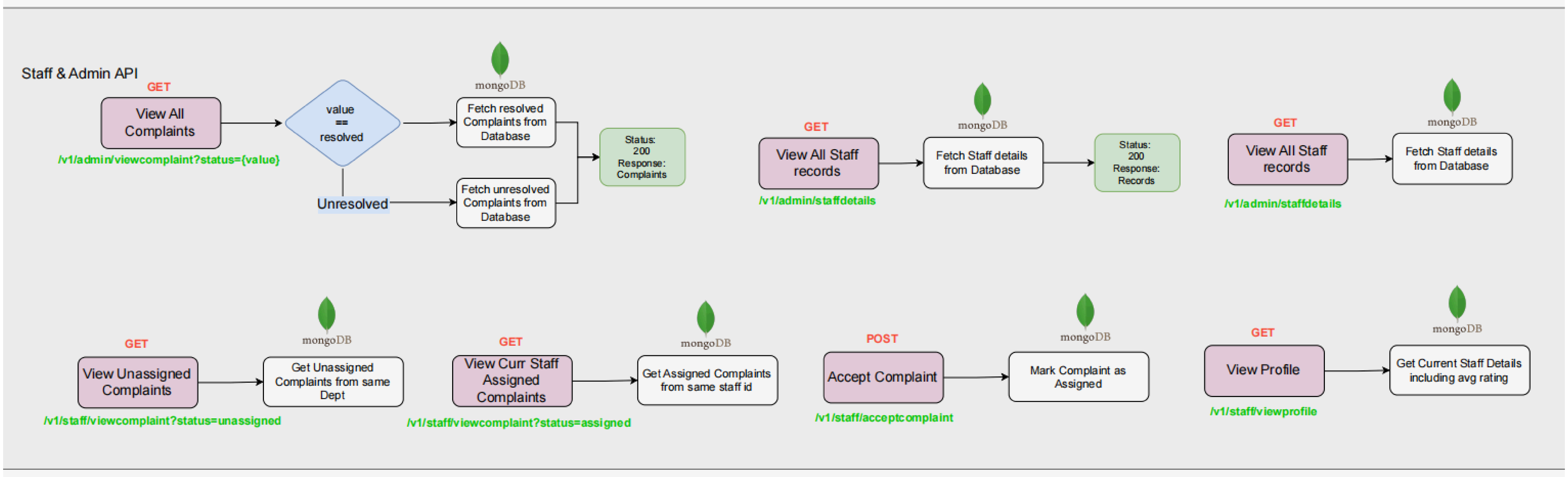


Staff & Admin API

GET

View All Complaints

/v1/admin/viewcomplaint?status={value}

value == resolved

mongoDB

Fetch resolved Complaints from Database

Unresolved

Fetch unresolved Complaints from Database

Status: 200 Response: Complaints

GET

View All Staff records

/v1/admin/staffdetails

mongoDB

Fetch Staff details from Database

Status: 200 Response: Records

GET

View All Staff records

/v1/admin/staffdetails

mongoDB

Fetch Staff details from Database

GET

View Unassigned Complaints

/v1/staff/viewcomplaint?status=unassigned

mongoDB

Get Unassigned Complaints from same Dept

GET

View Curr Staff Assigned Complaints

/v1/staff/viewcomplaint?status=assigned

mongoDB

Get Assigned Complaints from same staff id

POST

Accept Complaint

/v1/staff/acceptcomplaint

mongoDB

Mark Complaint as Assigned

GET

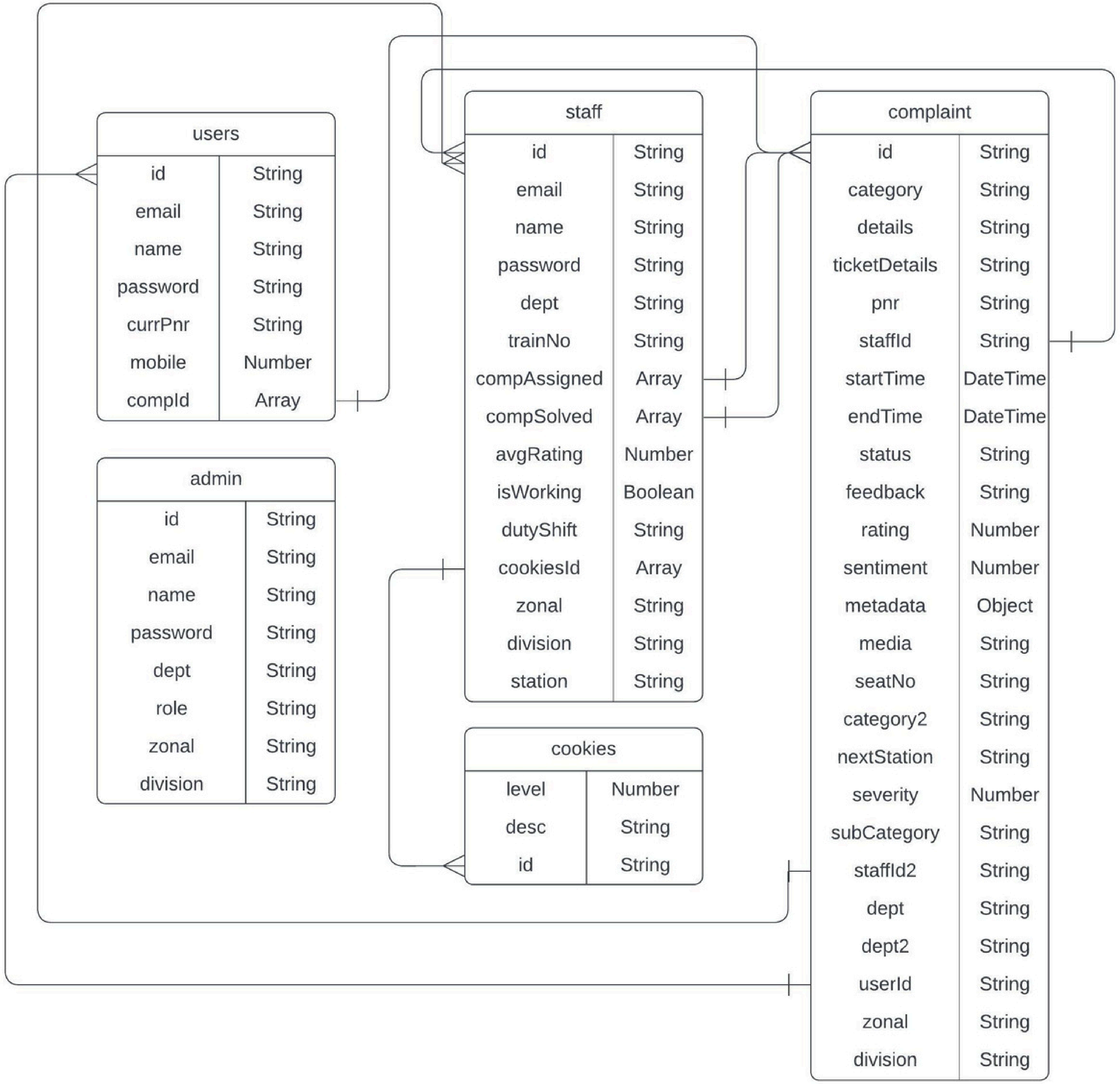
View Profile

/v1/staff/viewprofile

mongoDB

Get Current Staff Details including avg rating

Database Model



users	
id	String
email	String
name	String
password	String
currPnr	String
mobile	Number
compId	Array

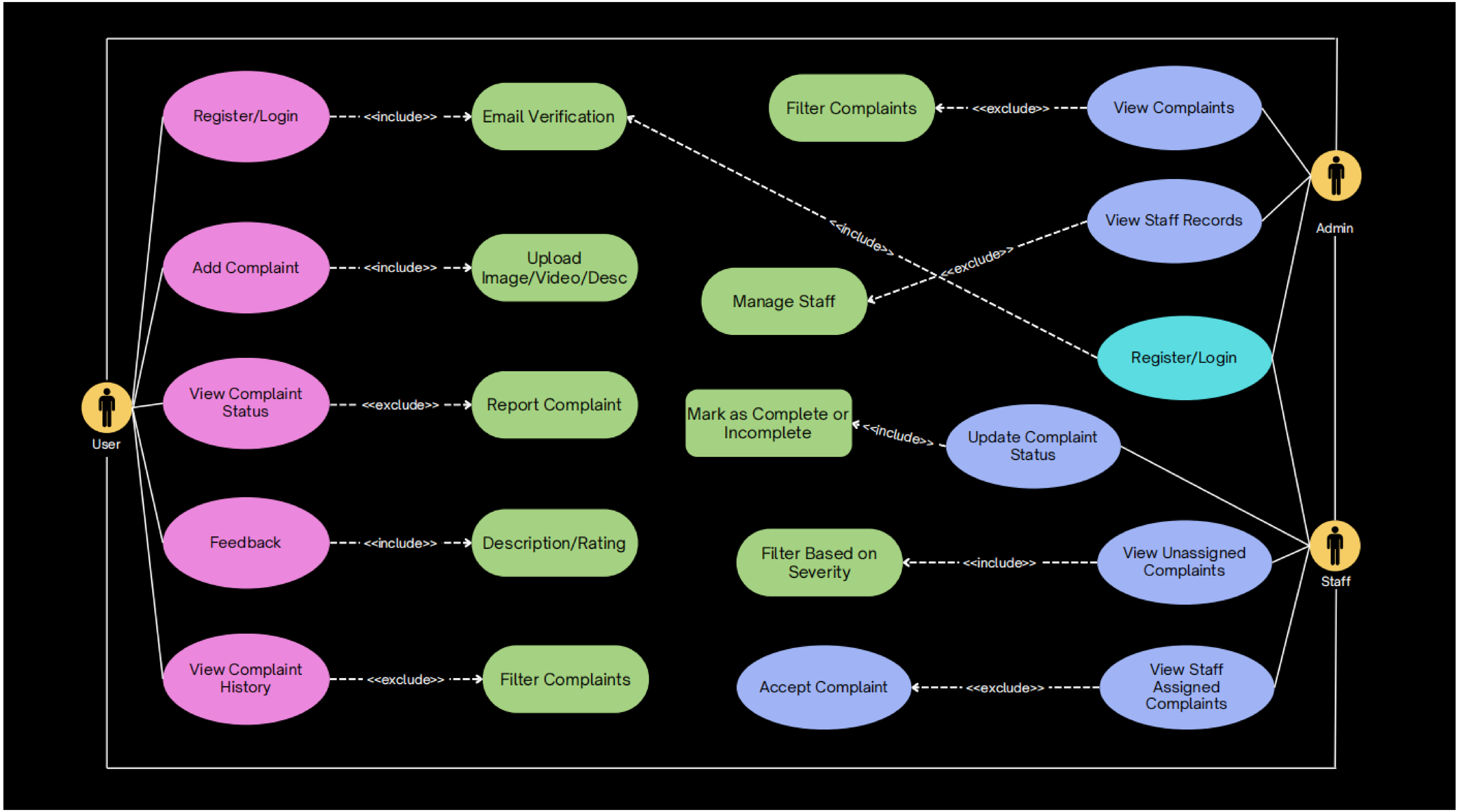
admin	
id	String
email	String
name	String
password	String
dept	String
role	String
zonal	String
division	String

staff	
id	String
email	String
name	String
password	String
dept	String
trainNo	String
compAssigned	Array
compSolved	Array
avgRating	Number
isWorking	Boolean
dutyShift	String
cookiesId	Array
zonal	String
division	String
station	String

cookies	
level	Number
desc	String
id	String

complaint	
id	String
category	String
details	String
ticketDetails	String
pnr	String
staffId	String
startTime	DateTime
endTime	DateTime
status	String
feedback	String
rating	Number
sentiment	Number
metadata	Object
media	String
seatNo	String
category2	String
nextStation	String
severity	Number
subCategory	String
staffId2	String
dept	String
dept2	String
userId	String
zonal	String
division	String

Use Case Diagram



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FEASIBILITY AND VIABILITY

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Operational Feasibility

Automated Categorization and Prioritization: Implementing CNNs for image and video analysis enhances complaint classification, boosting processing efficiency.

Enhanced Data Extraction: Utilizing OCR and metadata extraction provides additional context, leading to more precise and informed resolutions.

Automated Response & Routing: AI chatbots and smart routing algorithms streamline complaint handling and ensure timely resolution by directing complaints to the correct departments.

Predictive Maintenance: Machine learning models for predictive analytics forecast recurring issues, enabling proactive maintenance and reducing future complaints.

Feedback and Continuous Improvement: Sentiment analysis and performance monitoring drive ongoing improvements in the complaint resolution process.

Technical Feasibility

Integration with Existing Systems: Requires complex API development and data synchronization for seamless functionality.

Real-Time Processing: Needs efficient processing pipelines and low-latency infrastructure for timely analysis.

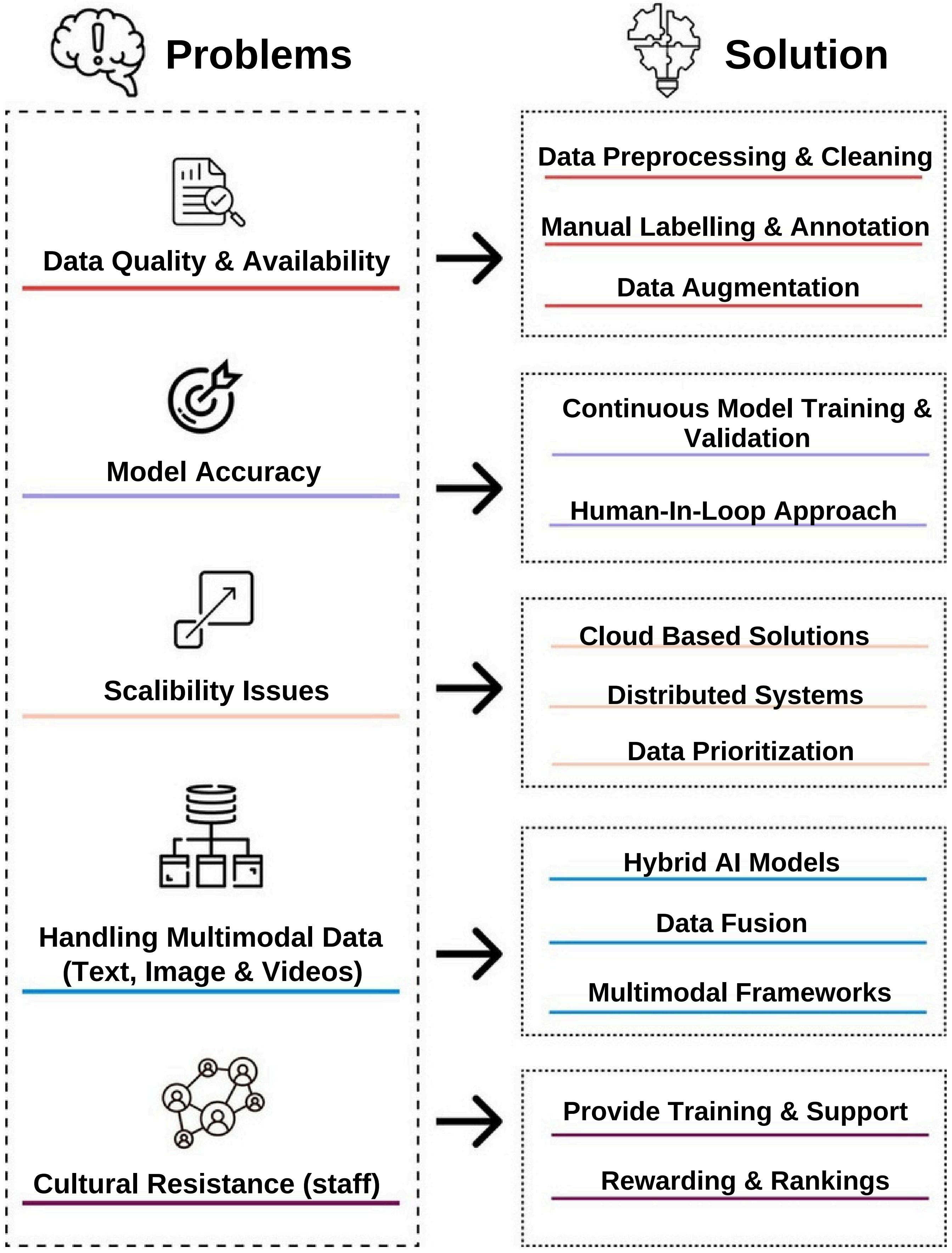
Scalability and Performance: Must optimize algorithms and use cloud solutions to handle large data volumes and varying loads.

Economic Feasibility

Cost of AI Integration: High initial investment in AI technologies and system integration but offers long-term efficiency gains.

Resource Allocation: AI-driven optimization can lead to cost savings by dynamically adjusting staffing and resources.

Maintenance and Updates: Ongoing costs for system maintenance & updates are balanced by improved resolution speed and accuracy.



Problems

Data Quality & Availability

Model Accuracy

Scalibility Issues

Handling Multimodal Data (Text, Image & Videos)

Cultural Resistance (staff)

Solution

Data Preprocessing & Cleaning

Manual Labelling & Annotation

Data Augmentation

Continuous Model Training & Validation

Human-In-Loop Approach

Cloud Based Solutions

Distributed Systems

Data Prioritization

Hybrid AI Models

Data Fusion

Multimodal Frameworks

Provide Training & Support

Rewarding & Rankings

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RESEARCH AND REFERENCES

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CNN for image categorization & prioritization	CNNs excel at image categorization by learning hierarchical features from raw data, while the final softmax layer provides confidence scores that can prioritize complaints based on classification certainty.	~~https://www.tensorflow.org/tuto~~ ~~rials/images/cnn~~
LSTM Model for Predicting Recurring Issue	LSTM models effectively capture temporal dependencies and long-term patterns in time-series data, making them ideal for predicting recurring issues by learning from historical trends and mitigating the vanishing gradient problem.	~~https://github.com/jaungiers/LSTM~~- ~~Neural-Network-for-Time-Series~~- ~~Prediction/tree/master~~
Sentiment Analysis using NLTK for User Feedback	NLTK (Natural Language Toolkit) effectively classifies sentiment in user feedback by analyzing text data and extracting sentiment scores, providing insights into user opinions and satisfaction levels.	~~https://www.kaggle.com/code/~~ ~~jonathanoheix/sentiment~~- ~~analysis-with-hotel-reviews~~
OpenCV for Image Preprocessing	OpenCV provides robust tools for image preprocessing, including techniques like filtering, resizing, and normalization, which enhance and prepare images for further analysis.	https://docs.opencv.org/4.x/d2/d96/tutorial_py_table_of_contents_imgproc.html
Flask API for Integration	Flask enables the creation of RESTful APIs for integrating various components by providing tools for routing, request handling, and CRUD operations.	~~https://medium.com/@dennisi~~ ~~vy/flask-restful-crud-api~~- c13c7d82c6e5text
Tesseract for OCR Text Extraction	Tesseract, accessed via the pytesseract library, provides powerful Optical Character Recognition (OCR) capabilities for extracting text from images.	~~https://pypi.org/project~~ ~~/pytesseract/~~
LLM Fine Tuning for Chatbot	Fine-tuning large language models (LLMs) allows for advanced chatbot development by adapting the model to specific conversational contexts and user interactions.	~~https://wandb.ai/mostafaibrahim17/ml~~- ~~articles/reports/Fine-Tuning-Llama-2-for-Advanced~~- Chatbot-Development-- Vmlldzo2NTY3ODUwparagraph text