

**TEAM
2025107**

Problem Statement & Objective

THE PROBLEM



In large organizations like Deloitte, tracking employee sentiment and well-being is crucial for sustaining productivity and culture.

EXISTING PROCESS

1

Employees at risk are selected based on Vibe scores and other employee data.

2

Then Individual meetings with HR is scheduled

CHALLENGES



Time-consuming

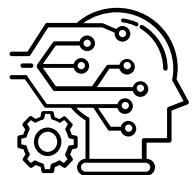


Resource-intensive

No real-time insights or automation



Difficult to scale with a growing workforce



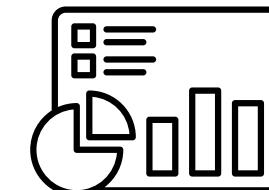
Proactively identify disengaged or distressed employees using **ML & anomaly detection**



Reach out via a **AI/GPT-powered chatbot** to collect contextual, empathetic feedback



Flag employees in need of HR attention based on **conversation analysis and sentiment scoring**



Provide **daily reports** and **dashboards** to HR with key insights and recommended actions

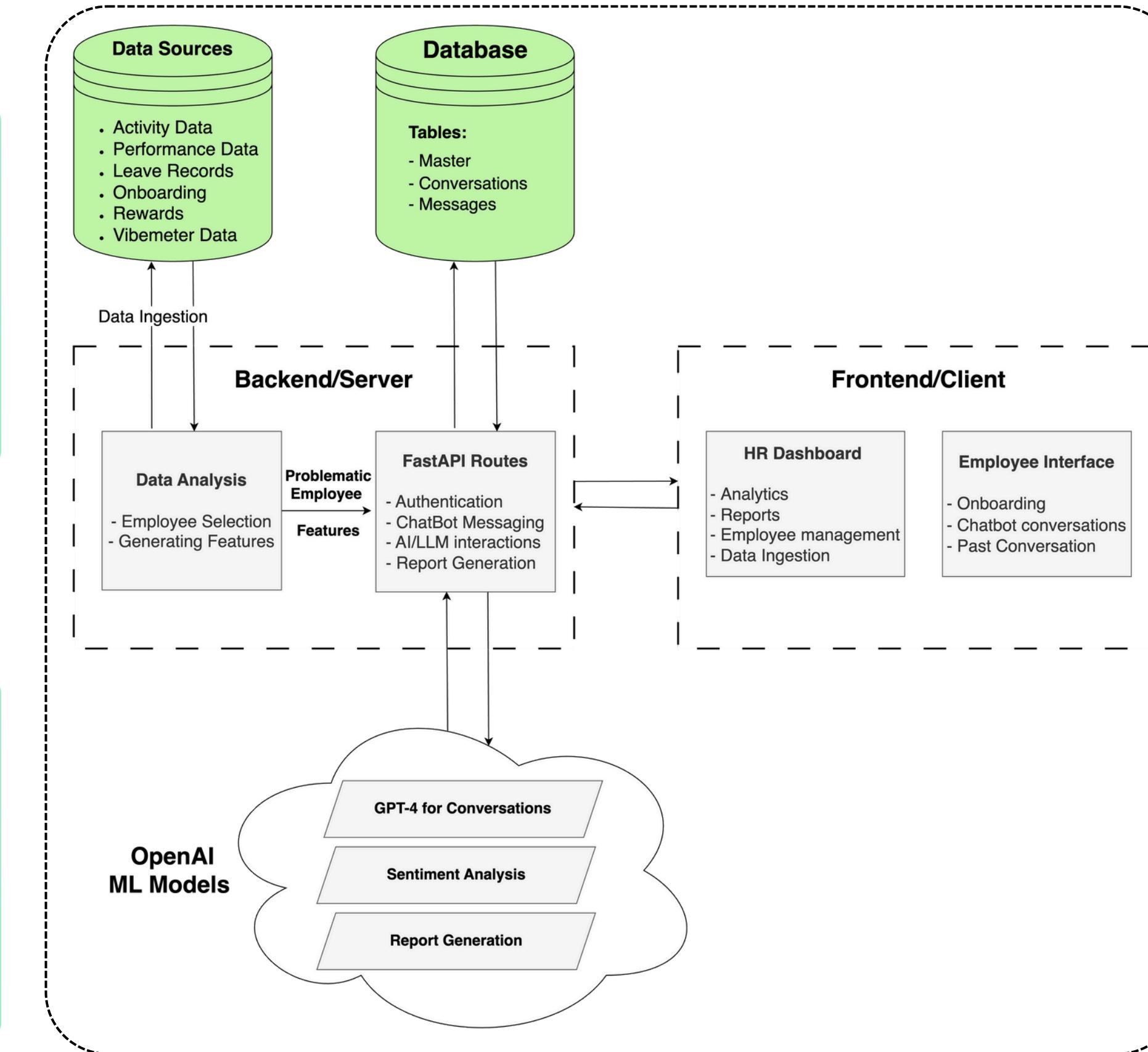
System Overview

OVERVIEW

-  The chatbot integrates multiple datasets (e.g., Vibemeter, performance reviews, leave records) to identify employees requiring engagement.
-  Provides real-time conversations and generates detailed reports for HR teams

WORKFLOW

1. Data ingestion
2. Employee selection using ML & SHAP values
3. Chatbot engagement
4. Sentiment analysis of the conversation
5. Reporting and escalation.



Architecture And Tech Stack

Tech Stack

FRONTEND



BACKEND



AI MODELS



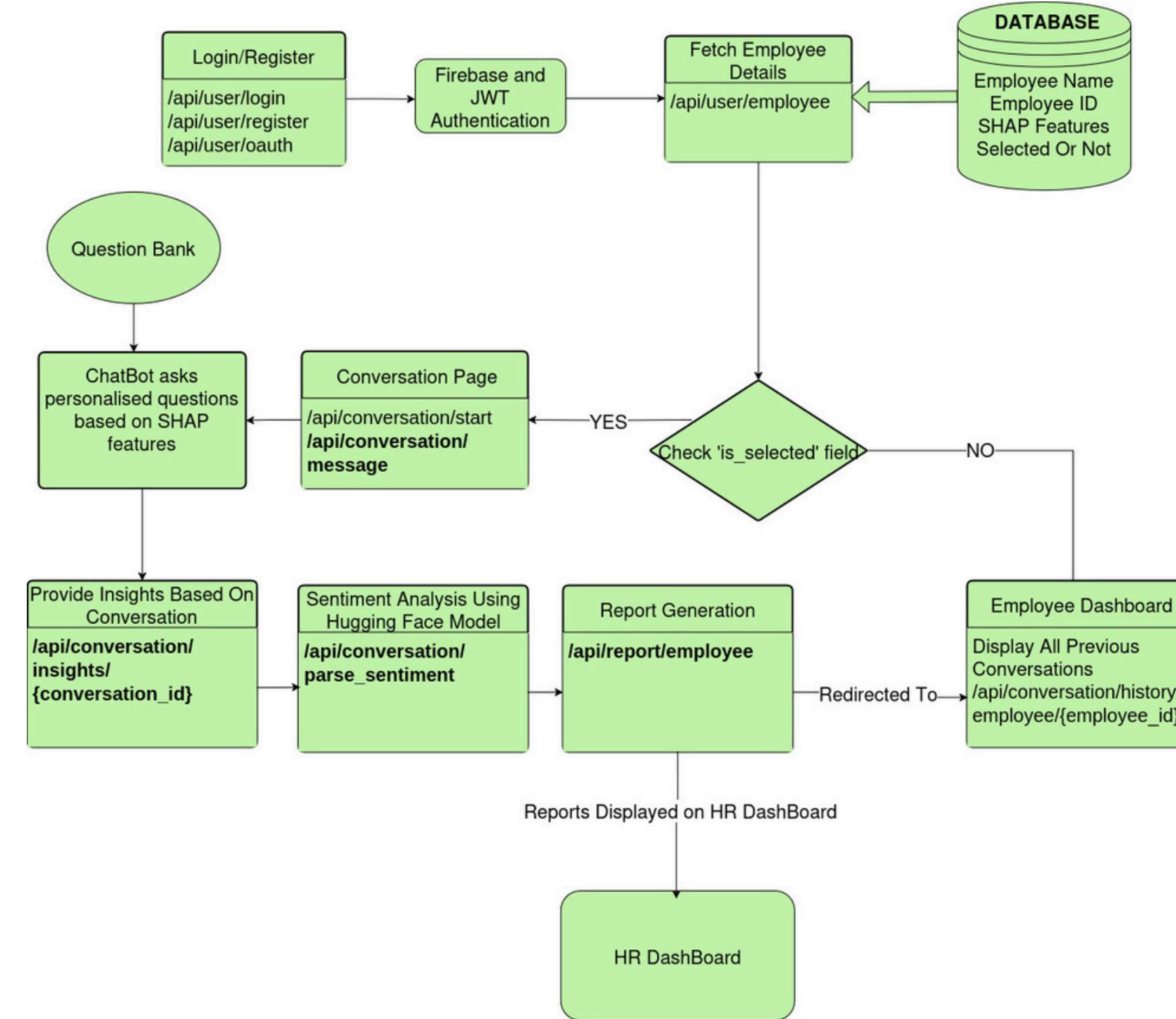
DEPLOYMENT



DATABASE

PostgreSQL on AWS RDS

System Architecture



WHY SHAP

Brings explainability and fairness to employee selection

Data Preparation: Feature engineering on 6 datasets

Anomaly Detection: Thresholding, Isolation Forest

Modeling: XGBoost Classifier + ADASYN (handles imbalance)

Explainability: SHAP values explain predictions

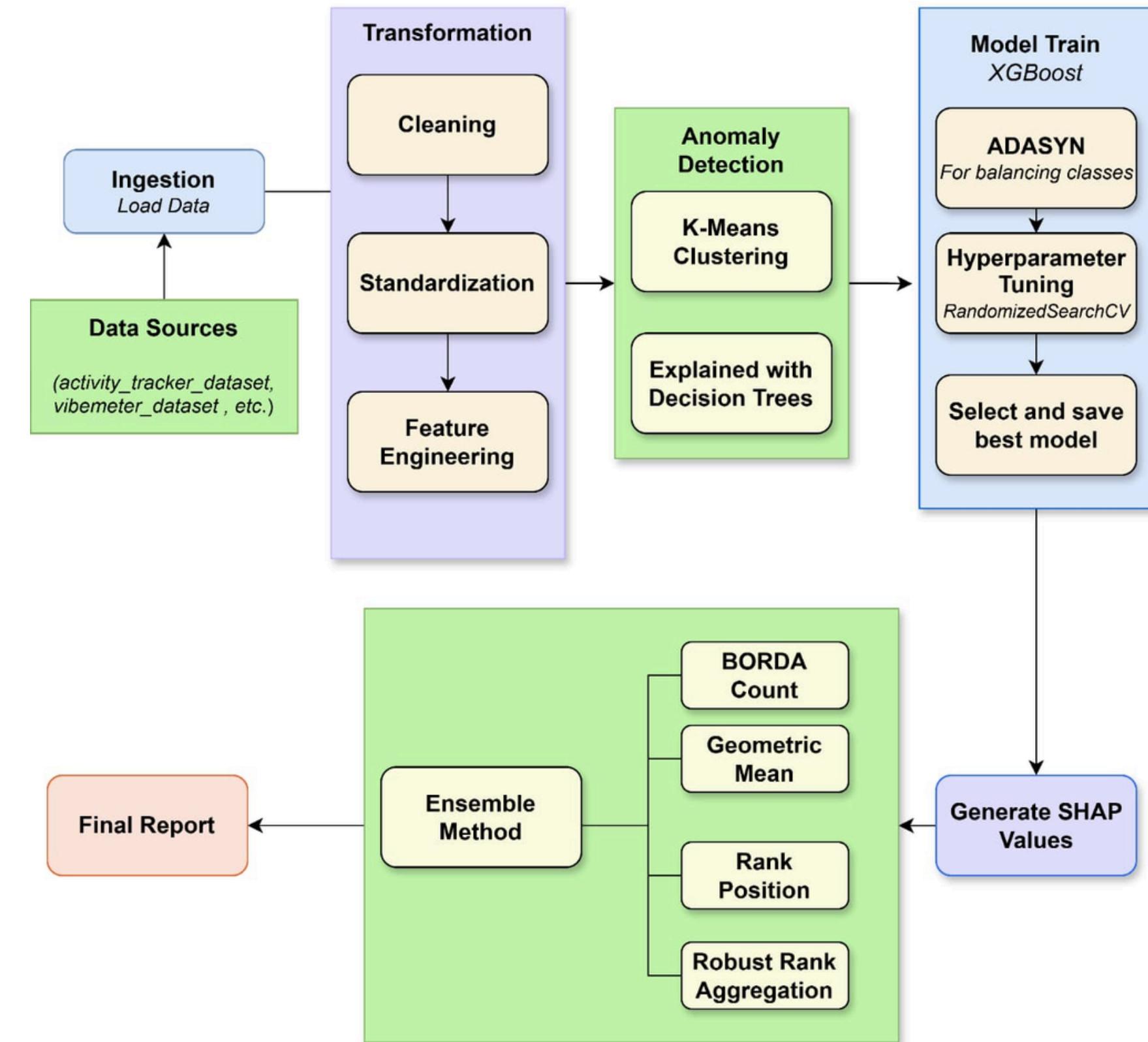
Ranking: Borda Count, Geometric Mean, RRA combine SHAPs

Output: final_results_aggregated.csv with flags and reasons

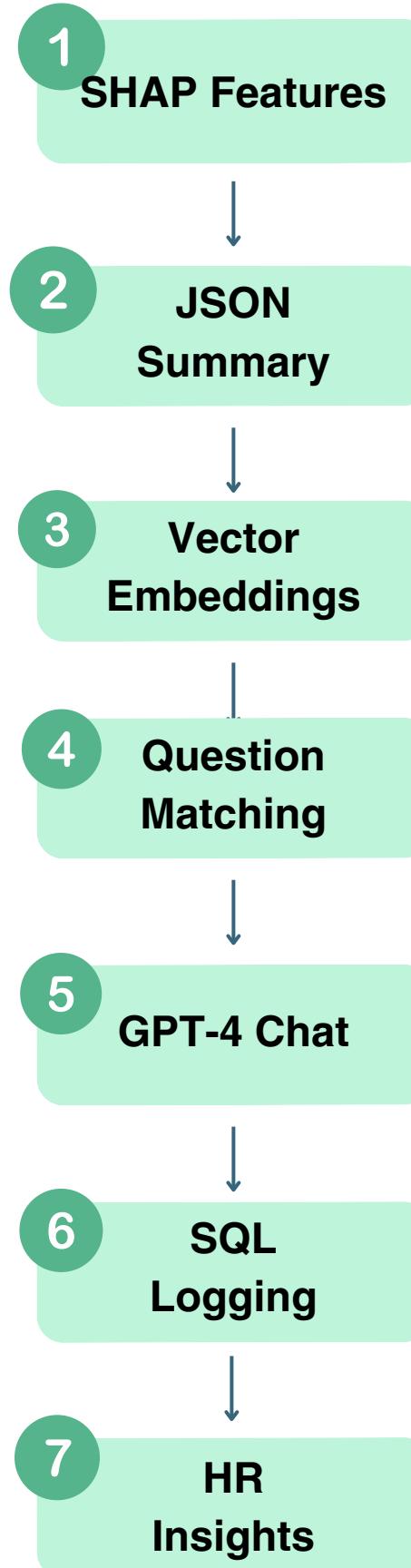
HOW EMPLOYEES ARE CHOSEN

Based on low vibe scores + high SHAP contribution from:

- Low performance ratings
- Excessive work hours
- Delayed rewards



Chatbot Workflow & Question Personalization



SHAP values are parsed into Positive Indicators & Negative Indicators and structured as a JSON for input.

The SHAP-based JSON is transformed into a natural language summary for each employee

This summary and pre-curated question bank is embedded into a vector using: [sentence-transformers/all-MiniLM-L6-v2](#)

Top 20 most relevant questions are selected using cosine similarity with the employee summary vector.

GPT-4 powers a dynamic context-aware chatbot with:

- Relevant follow-ups using `generate_follow_up()` method
- Contradiction detection with `detect_contradiction()` for deeper insight

Each conversation is stored in SQL Database used for:

- Sentiment scoring
- Report generation
- HR interventions



The Chatbot is enabled with both **text to speech** & **speech to text** transcription

Function	Description
<code>generate_follow_up()</code>	Generates 2 custom follow-ups based on user response
<code>detect_contradiction()</code>	Catches inconsistencies in employee responses and probes deeper
<code>get_context_vector()</code>	Converts SHAP insights into embedding for question matching

Reporting, Insights & Flagging Mechanism

Report Generation

- Generated daily reports from chatbot interactions and SHAP insights.
- Provides summaries, insights, and prioritized employee lists.

From all the completed conversations at the HR_dashboard

Sentimental Analysis

- The system uses a pre-trained ***DistilBERT emotion classifier*** to analyze employee messages.
- The model calculates a severity score (0-100) based on the intensity of negative emotions like **sadness** and **anger**.

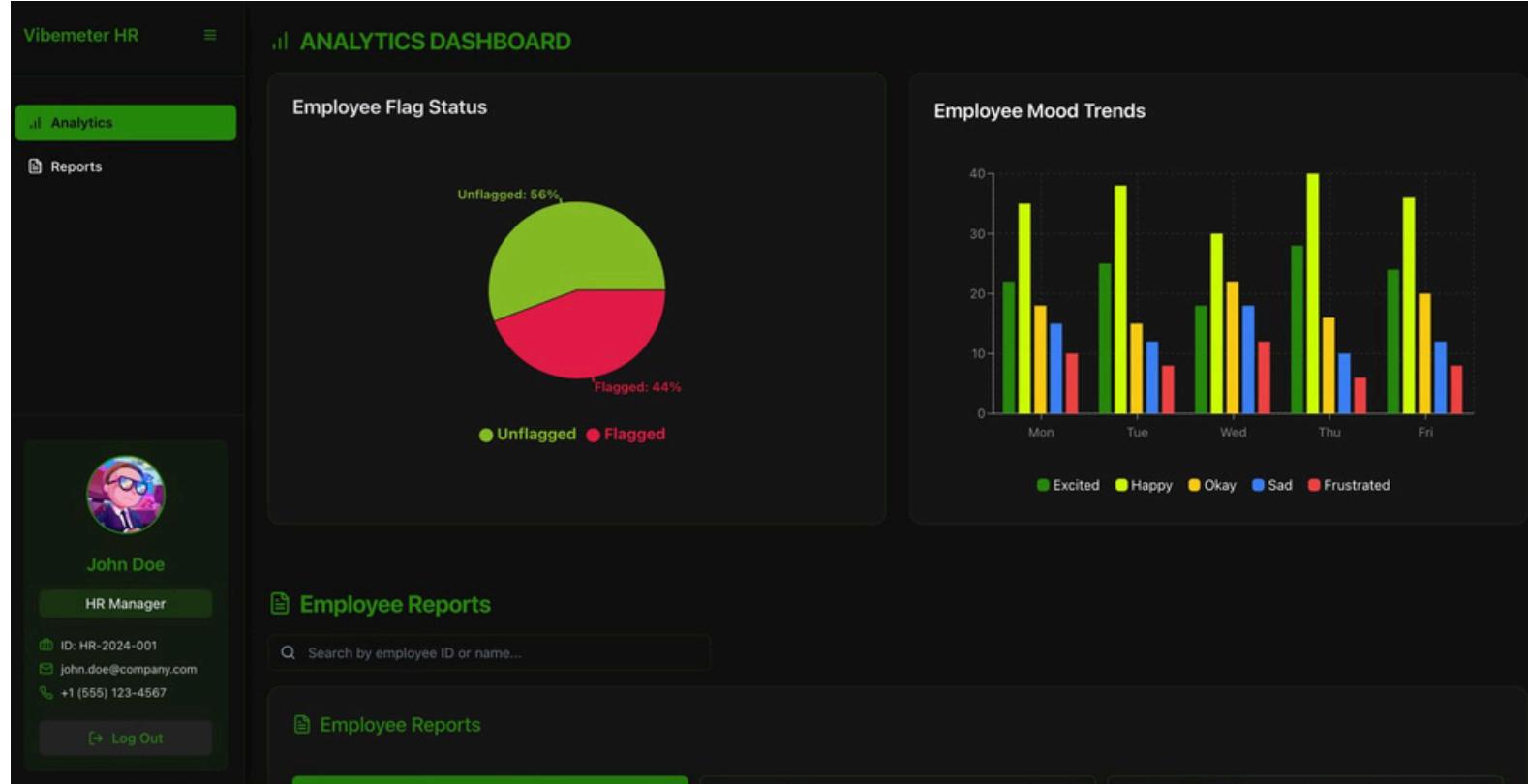
Insights Generation

Detailed analytics dashboard with:

- Common causes of dissatisfaction (e.g., workload, recognition).
- Recommendations for proactive HR actions.

Flagging Mechanism

- High SHAP anomaly scores.
- Negative sentiment threshold breaches.
- Critical issues identified in chatbot conversations.



Challenges, Innovations & System Impact

Challenge	Description	Resolution
SHAP Parsing Complexity	Inconsistent formatting in raw CSVs from different sources	<i>Built robust parsing logic with type-checks & error handling</i>
Frontend-Backend Auth Sync	JWT handling caused race conditions during login	Used React Context + token refresh middleware in FastAPI
Tailwind Upgrade Issues	Tailwind v4 introduced breaking class changes	Refactored styles and migrated configs using JIT mode
Sentiment Analysis Accuracy	Poor results due to generic model responses	Fine-tuned DistilBERT on HR-specific interaction samples
Deployment Errors (CORS)	API calls failed in production environments	Implemented strict domain whitelisting in CORS config
Concurrent Load Bottlenecks	Slow responses under parallel usage	Optimized DB queries & used async FastAPI endpoints

This system integrates SHAP-based explainability with rank aggregation (Borda, Geometric Mean, RRA) for fair employee prioritization. GPT-powered embeddings (MiniLM) match SHAP outputs to chatbot questions, enabling personalized engagement. A contradiction detection module flags inconsistencies in responses to enhance conversational depth.

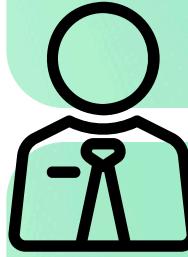
★ Modular Design

- Plug-and-play architecture: Each module (ML, Explainability, Chatbot) is independently deployable.
- Unified six data sources via modular transformation pipelines.

- 70% reduction in HR's manual feedback processing.
- Real-time emotional check-ins for employees.
- Improved satisfaction and reduced attrition through scalable engagement.

Employee Flow flow

- Landing → Login → Dashboard → Chatbot



Employee Flow

Landing Page:

Login Modal:

- Email + Password
- Option: Login via Google (OAuth)

Dashboard:

Shows:

- Recent mood trends
- Chatbot access
- Vibe score history
- Feedback from last interaction

Chat Interface:

- GPT-powered chat
- Typing indicator, timestamps, emoji reaction
- Sidebar for sentiment stats (Live SHAP reasons)

Employee Flow flow

- Login → Dashboard → Analytics → Action



HR Flow

HR Login (Separate Access)

- Cards for:
 - Flagged Employees
 - Daily Reports
 - Conversation Summaries

Charts:

- Activity-wise vibe averages
- Escalation rates

Color Scheme:

- Primary: Emerald Green #009A44 → Symbolizes wellness and positivity

- Background: Dark Gray #131313 for a sleek, focused interface
- Accent: Light Green #A9FFCF for success states & highlights

Typography:

 Inter (clean, modern, accessible)

Style: Glassmorphism on modals, shadowed cards, soft hover animations

Future Scope

HRMS Platform Integrations

- Plug into tools like SAP SuccessFactors, Workday, or Zoho People
- Automate syncing of performance, leave, and promotion data

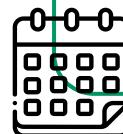


Advanced Emotion AI

- Integrate voice tone, facial expression (where possible), and text sentiment for richer engagement insights

Calendar & Task Integration

- Connect with Google Calendar / Outlook
- Auto-schedule follow-ups for flagged employees



Predictive Analytics

- Use historical trends to forecast:**
- Potential disengagement
 - Team morale drops
 - Escalation likelihood



Multi-Language Support

- Use multilingual LLMs to ensure inclusivity across global teams

