

# **Hotel & Restaurant Review Management System**

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Team LETHYS

IN2901 - Software Development Project

Faculty of Information Technology

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## 1. Project Overview

The Hotel & Restaurant Review Analysis & Response System is a Software-as-a-Service (SaaS) platform designed to help hotels efficiently manage, analyze, and respond to online customer feedback across multiple review platforms.

In today's competitive hospitality industry, customer reviews on Booking.com, Agoda, TripAdvisor, and Google Maps have a major influence on a hotel & restaurant's reputation and business success. However, monitoring and interpreting these reviews manually is inefficient, error-prone, and scattered across platforms.

This system provides an end-to-end automated solution that consolidates all hotel & restaurant reviews into a single centralized dashboard. Using Playwright-based web scraping and API integrations, the platform automatically gathers reviews from supported sources, cleans and structures them, and stores them in a secure multi-tenant database.

The integrated AI and NLP engine performs sentiment classification, topic-based categorization, and response generation, enabling hotel & restaurant administrators to quickly identify trends such as recurring issues with staff behavior, room cleanliness, or food quality.

The platform's interactive React-based dashboard visualizes key metrics like sentiment distribution, review trends, and topic frequency, helping managers make data-driven decisions.

As a SaaS model, the system offers tiered subscription plans (Free, Plus, and AI Pro) — each with different review limits, features, and AI capabilities — enabling hotels of all sizes to adopt it according to their operational scale.

The entire system is designed for high availability and scalability, powered by cloud architecture using Amazon Web Services (AWS). It employs Kubernetes (K8s) for container orchestration, Redis for intelligent caching.

The Hotel & Restaurant Review Analysis & Response System offers a reliable, secure, and scalable solution for hotel & restaurant reputation management.

## 2. Objectives

The main objectives of the proposed project are as follows:

- (1) Automate the process of collecting hotel & restaurant reviews from multiple platforms in real time.
- (2) Analyze and classify reviews using NLP techniques into positive, neutral, and negative sentiments.
- (3) Identify common topics or issues (such as Wi-Fi, food quality, staff behavior, room cleanliness, etc.) through keyword and entity extraction.
- (4) Generate AI-based automatic responses to customer reviews to assist hotel & restaurant management in communication.
- (5) Visualize key insights and performance analytics through an interactive dashboard.
- (6) Enable historical data analysis to monitor service trends and customer satisfaction over time.
- (7) Improve operational efficiency by minimizing manual monitoring and response delays.

## 3. Project Scope

The scope of the project covers all aspects of automated hotel & restaurant review management — from data collection to AI-powered insights and response generation.

### In-Scope Components:

- Review data extraction from supported public hotel and restaurant review platforms.
- Data cleaning, processing, and structured storage in a relational database.
- Sentiment analysis and topic detection using AI/NLP models.
- Generation of automated, personalized responses to reviews.
- Visualization of review trends, performance analytics, and sentiment graphs via a web interface.
- Role-based access for hotel and restaurant administrators and management staff.
- Hosting and deployment of the full system on a cloud-based VPS.

#### **Out-of-Scope Components:**

- Direct posting of responses on third-party platforms (unless their APIs allow).
- Review moderation for platforms requiring manual approval.
- Integration with non-public APIs that require paid access.

## **4. Key Features / Functionalities**

### **A. Web Scraping & Data Aggregation**

- Automated data collection from multiple hotel and restaurant review websites.
- Handling dynamic content using Playwright and asynchronous scraping.
- Duplicate detection and data normalization.

### **B. Data Storage & Management**

- Relational database structure using MS SQL Server for storing reviews, user data, and analytics.
- Efficient query handling for large datasets.
- Redis caching for performance optimization.

### **C. Sentiment and Topic Analysis**

- Sentiment detection using pre-trained and fine-tuned transformer models.
- Keyword and entity extraction to identify most discussed topics.
- Review classification based on emotional tone and service category.

### **D. AI-Generated Responses**

- Context-aware automatic response generation to customer reviews.
- Review summarization for management convenience.
- Manual editing option for managers before publishing.

### **E. Interactive Web Dashboard**

- Real-time visualization of review sentiment distribution, star ratings, and performance over time.
- Filter and search by country, topic, or review type.
- User management and role-based access controls.

## **F. Analytics & Reporting**

- Generation of daily, weekly, and monthly performance reports.
- Export options (PDF/CSV) for internal analysis.
- Identification of recurring problems and service trends.

## **G. SaaS Model and Multi-Tenant Architecture**

- Cloud-based Software-as-a-Service (SaaS) platform.
- Multi-tenant design with secure data isolation per hotel and restaurant.
- Tiered subscription plans (Free, Plus, AI Pro) with scalable limits.
- Kubernetes orchestration for auto-scaling and load balancing.
- Deployable on AWS for flexible hosting.

# **5. Suggested Technologies**

<b>Category</b>	<b>Technology / Tool</b>	<b>Purpose</b>
Frontend	React.js, TailwindCSS, Chart.js	Building responsive and interactive dashboards
Backend	FastAPI (Python)	API development and server-side logic
Database	Microsoft SQL Server	Structured data storage and analytics
Caching	Redis	Fast data retrieval and performance optimization
Web Scraping	Playwright (Python)	Automated data collection from dynamic web pages
AI / NLP	HuggingFace Transformers, spaCy, NLTK	Sentiment analysis, topic extraction, and response generation
Hosting / Deployment	AWS	Cloud hosting and CI/CD deployment

Containerization & Orchestration	Docker, Kubernetes (K8s)	Application scalability and reliability
Version Control	GitHub	Team collaboration and version tracking

*These technologies were selected to align with modern industry practices, ensuring scalability, maintainability, and compatibility with cloud-based solutions.*

## 6. Team Member Details

Team Name : *LETHYS*

Member Name	Registration No.	Primary Responsibilities
A.A.P.R. Jayathilaka	234096J	<ul style="list-style-type: none"> <li>• <b>Scraping ,Data Ingestion ,Source Management</b></li>   <li>• <b>Management Frontend Pages/Modules:</b>            /sources: User-side connector management (add/pause/run now)            /admin/scraping: Admin control of global scrapers            Log viewer &amp; status dashboard: Realtime job history            Modals: Add/Edit connector, test run         </li>   <li>• <b>Backend Modules:</b> sources, scraping_jobs, scheduler            Implement connectors (Booking, TripAdvisor, etc.)            Normalization, deduplication, retry policies            Celery/APScheduler for schedules</li>   <b>DB tables:</b> sources, scraping_jobs,        </ul>

		<p>ingestion_runs Redis: Job queues + status cache AWS: Store raw JSONs</p>
M.G.K.I. Udithya	234211K	<ul style="list-style-type: none"> <li><b>LLM Fine-Tuning ,ML Ops ,DevOps &amp; Infrastructure</b></li> <li><b>Frontend Pages/Modules:</b>            /groups: Group creation + branch list            /groups/[id]: Brand overview + AI summary            /admin/monitoring: Infra dashboards (metrics/logs)            Shared components: Charts, leaderboards, model status cards         </li> <li><b>Backend/Infra Modules:</b> ml_finetune , ml_inference            Prepare datasets from reviews            Fine-tune LLM (model training job)            Deploy model to GPU pod via K8s            Evaluate and version models         </li> <li><b>DevOps/AWS/Kubernetes:</b>            Terraform            Helm charts for services            CI/CD pipelines (GitHub Actions → ECR → EKS)            Monitoring (Prometheus/Grafana/CloudWatch)         </li> <li><b>DB tables:</b> groups, group_members, ml_models, fine_tune_jobs</li> </ul>
M.D. Wakishta	234217J	<ul style="list-style-type: none"> <li><b>Evaluation Comparative of Competitors &amp; Domain</b></li> <li><b>Analytics Frontend Pages/Modules:</b>            /competitors: Domain selector + suggested competitors            /competitors/[id]: Competitor analysis charts         </li> </ul>

		<p>/domains: Domain overview &amp; comparison  Components: Aspect radar, trend charts, tables</p> <ul style="list-style-type: none"> <li>• <b>Backend Modules:</b> competitors , domains , analytics  Compute domain averages &amp; competitor rankings  LLM summary: “Competitor Insights”  Redis cache for analytics</li> </ul> <p><b>DB tables:</b> domains, competitors, competitor_relations</p>
P.D. Hettiarachchi	234080F	<ul style="list-style-type: none"> <li>• <b>Reviews ,AI Reply ,Insights Dashboard</b></li> <li>• <b>Frontend Pages/Modules:</b>  /dashboard: KPIs, quick insights  /reviews: Review table with filters  /reviews/[id]: Detail drawer + AI reply editor  /insights: Charts + word cloud + trend summary</li> <li>• <b>Backend Modules:</b> reviews , review_replies , sentiment , insights Integrate with ML service (/ml/analyze, /ml/reply)  Aggregations &amp; trend analytics  Redis cache for review lists &amp; AI summaries  Alert rules (low rating trigger)</li> </ul> <p><b>DB tables:</b> reviews, review_aspects, review_replies</p> <p><b>Notes:</b> Core customer-facing module; AI-inference heavy but no fine-tuning.</p>
W.H. Ashara	234023K	<ul style="list-style-type: none"> <li>• <b>Authentication ,User ,Organization ,Admin Management</b></li> <li>• <b>Frontend Pages/Modules:</b>  /login, /signup, /forgot-password: Auth flows  /settings/profile, /settings/organization,  -/settings/notifications: User/org settings</li> </ul>

		<p>/admin/users, /admin/organizations,        -/admin/feature-flags, /admin/settings: Admin        -console management</p> <p>Shared components: Forms, tables, modals,        role toggles</p> <ul style="list-style-type: none"> <li>• <b>Backend Modules:</b> auth , users ,            organizations, roles , feature_flags JWT +            OAuth auth, RBAC, audit logs, org CRUD</li> </ul> <p><b>DB tables:</b> users, organizations, roles,        audit_logs, feature_flags</p> <p>Expose /admin/* API endpoints</p> <p>Shared middleware (security, logging)</p>
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**Supervisor:** Ms. A. Pirapaharan

## 7. Conclusion

The Hotel and Restaurant Review Analysis & Response System delivers a unified, cloud-based solution that revolutionizes how hotels and restaurants collect and interpret online customer feedback.

By combining automated web scraping, NLP-driven sentiment analysis, and AI-powered response generation within a SaaS delivery model, it provides an efficient and scalable approach to review management.

Through Kubernetes-orchestrated microservices, AWS hosting, and intelligent caching via Redis, the system ensures high availability, security, and performance even under heavy workloads. Its flexible subscription plans make it accessible to hotels and restaurants of all sizes — from small establishments to enterprise chains — offering the right balance between functionality, cost, and automation.

Ultimately, this project represents a practical and innovative application of modern cloud and AI technologies in the hospitality sector, enabling hotels and restaurants to make smarter, faster, and more data-driven business decisions.