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Complaint Management System named as 'Gantavya' For Railways

Minor Project Report

Submitted for the partial fulfillment of the degree of

Bachelor of Technology

In

Internet of Things (IOT)

Submitted By

Vaibhav Shivhare
0901IO221074

UNDER THE SUPERVISION AND GUIDANCE OF

Dr.Dhananjay Bisen
Assistant Professor

Centre for Internet of Things

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR (M.P.), INDIA
माधव प्रौद्योगिकी एवं विज्ञान संस्थान, ग्वालियर (म.प्र.), भारत
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June 2024

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I hereby declare that the work entitled **"Complaint Management System named as 'Gantavya' For Railways"** is my work, conducted under the supervision of **Dr.Dhananjay Bisen, Assistant Professor,** during the session Jan-May 2024. The report submitted by me is a record of bonafide work carried out by me.

I further declare that the work reported in this report has not been submitted and will not be submitted, either in part or in full, for the award of any other degree or diploma in this institute or any other institute or university.

Vaibhav Shivhare
0901IO221074
B.Tech. V Sem

Date: 19th nov 2024
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This is to certify that the above statement made by the candidates is correct to the best of my knowledge and belief.

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9/11/24

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PLAGIARISM CHECK CERTIFICATE

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ABSTRACT

Railway grievance management is an integral part of customer experience, but most solutions available fail to classify complaints as multiscale. The users using the Rail Madad portal themselves need to categorize and assign their grievances through essentially manual processes that induce inefficiency and delay in the resolution. The sheer number and complexity of complaints growing make the case for such a scalable, smart, and automated solution.

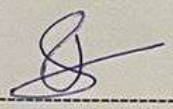
Gantavya, developed using Next.js, is an advanced web chatbot that is replacing the existing Rail Madad website and Disha/Railmadad apps. The Large Language Models (LLMs), image-to-text models, and advanced analytics applied in Gantavya automatically categorize, prioritize, and route complaints faster and with better accuracy. Some of the features include OCR - extracting textual data; urgency detection to optimize the order of complaints; instant acknowledgement and collection of feedback from AI-powered chatbots.

Gantavya makes tools for predictive maintenance, resource allocation, and sentiment analysis. In one line, "It provides an easy means for the railway authorities to take a proactive approach to service enhancement." Gantavya will deliver improved scalability, operational efficiency, and passenger satisfaction-benchmarking AI-driven complaint management in the railway sector, with smooth integration with existing systems.

ACKNOWLEDGEMENT

The full semester Internship/ Project has proved to be pivotal to my career. I am thankful to my institute, **Madhav Institute of Technology & Science** to allow me to continue my disciplinary/interdisciplinary Internship/ Project as a curriculum requirement, under the provisions of the Flexible Curriculum Scheme approved by the Academic Council of the institute. I extend my gratitude to the Director of the institute, **Dr. R. K. Pandit** and Dean Academics, **Dr. Manjaree Pandit** for this.

I would sincerely like to thank my department, **Centre for Internet of Things,** for allowing me to explore this project. I humbly thank **Dr. Praveen Bansal**, Assistant Professor and Coordinator, Centre for Internet of Things, for his continued support during the course of this engagement, which eased the process and formalities involved. I am sincerely thankful to my faculty mentors. I am grateful to the guidance of **Dr. Dhananjay Bisen**, Assistant Professor, and Centre for Internet of Things, for his continued support and guidance throughout the project. I am also very thankful to the faculty and staff of the department.



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CONTENT

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ACRONYMS

Acronym	Full Form
AI	Artificial Intelligence
OCR	Optical Character Recognition
LLM	Large Language Model
AWS	Amazon Web Services
NLP	Natural Language Processing
S3	Simple Storage Service
UI	User Interface
UX	User Experience
DB	Database
ML	Machine Learning

NOMENCLATURE

Term	Description
Gantavya	A web-based chatbot designed to enhance the complaint management system for Railways.
Rail Madad	Existing grievance redressal platform for railway passengers in India.
Multimodal AI	AI technology capable of processing multiple data formats, such as text, images, and videos.
Complaint Categorization	The process of classifying complaints into predefined categories for efficient routing and resolution.
Complaint Prioritization	Assessing the urgency or severity of a complaint to determine its priority for resolution.
Metadata	Data providing additional context, such as timestamps, geolocation, and file attributes.
Predictive Maintenance	Using AI to forecast potential issues based on historical and real-time data trends.
Sentiment Analysis	AI-driven process to determine the emotional tone of user feedback.
LangChain	A framework for building applications powered by language models.
Vercel	A platform for deploying and hosting web applications.
MongoDB	A NoSQL database used for flexible and scalable data storage.
Next.js	A React-based framework for building user interfaces and web applications.
Tailwind CSS	A utility-first CSS framework used for designing responsive and modern interfaces.

CHAPTER 1: INTRODUCTION

Effective resolution of complaints is essential for maintaining high operational standards and earning passenger trust in railway systems. Platforms like Rail Madad play a vital role in allowing passengers to voice their concerns. Nonetheless, the current process demands considerable manual work for classifying, directing to departments, and resolving issues. This reliance often leads to slow replies, poor resource management, and limited growth potential.

Contemporary railway services need a smart, automated system that can manage various types of complaints, such as images, videos, and audio, while guaranteeing prompt and precise resolutions. Gantavya fills this void with an AI-backed approach that revolutionizes the complaint management cycle. The platform utilizes cutting-edge AI technologies, including Large Language Models (LLMs) and multi-modal image-to-text frameworks, to effectively handle multimedia complaints.

By incorporating Optical Character Recognition (OCR) for extracting text and using metadata analysis for enriching context, Gantavya facilitates automated classification, urgency identification, and efficient complaint routing. Furthermore, its predictive maintenance features empower railway authorities to foresee recurring problems and allocate resources more effectively. These capabilities are enhanced by AI-driven chatbots for immediate communication and sentiment analysis tools that assess user satisfaction and feedback.

Gantavya is built to integrate smoothly with the existing Rail Madad system, promoting scalability, an improved user experience, and better operational efficiency. This document details the platform's design, features, and its potential to transform the railway complaint resolution process in India.

By bringing in Gantavya, a chatbot with capabilities like self-categorisation of complaints that can be done automatically or in real time with assistance, and complaint tracking, we will move a long way in bringing the overall passenger experience on Indian Railways to an optimal level:

1. **Customer Satisfaction**: Gantavya will deliver quick and efficient solutions to the problems faced by passengers, thus enhancing their satisfaction and loyalty.
2. **Complaint Resolution**: The automated categorisation system will ensure quick and correct redressal of complaints, thereby reducing resolution times.
3. **Reduced Operational Costs**: Gantavya will help the Indian Railways reduce its operational costs through automation of some tasks, such as the categorization of complaints and the initial act of assistance.
4. **Efficient Management**: The chatbot will streamline the complaint management process to free up time for railway staff to handle more complex issues.
5. **Increased Accessibility**: Gantavya would indeed make reporting cases of problems and receiving help accessible and convenient, wherever a traveler is or at whatever time zone.

To enhance Gantavya 's utility and attract a wider user base, we propose adding some dedicated services that could include parcel and freight services. This would add up to the increasing demand for an effective and reliable logistics solution and provide more value to users and Railways.

UI/UX

Such an intuitive, user-friendly design of Gantavya will make easy navigation and interaction with the chatbot possible, so that the Experience becomes worthwhile. Moreover, the Next.js website should be a modern web application with a rich, pleasant interface: the information will be accessible and easy to interact with the chatbot by the users.

CHAPTER 2: LITERATURE SURVEY

The emergence of Artificial Intelligence (AI) has greatly transformed complaint management systems, allowing for quicker and more precise resolution of consumer issues. Numerous studies and applications in the transportation field, especially in railways, underscore the significance of automated systems in boosting operational productivity and enhancing customer satisfaction. This literature review delves into the developments in AI-powered complaint resolution mechanisms, particularly spotlighting technologies such as multimodal AI, Optical Character Recognition (OCR), and smart chatbots.

The research highlights that incorporating AI-driven solutions, including multimodal AI for categorizing problems, OCR for extracting information, and chatbots for immediate support, can significantly upgrade conventional complaint management systems. Although there are challenges related to system integration, progress in cloud computing and scalable architectures offers hopeful solutions. These findings strengthen the potential of the Gantavya platform to improve the Rail Madad system, rendering it more effective, user-friendly, and capable of efficiently managing extensive complaint volumes.

CHAPTER 3: SYSTEM DESIGN AND PROPOSED SOLUTION

SYSTEM DESIGN

The architecture of the Gantavya platform is designed with great care, so it is properly efficient and scalable. Every module contributes to solving a very significant problem in complaint management systems:

Frontend Design:
Application built on Next.js for the fast, seamless, interactive nature of user experience.
Styled with Tailwind CSS, allowing a very responsive and modern user interface.
One also has the facility of accessing the platform through multiple devices, which is pretty easy for passengers to register their complaints in a quick manner.

Backend Architecture:
The Backend System runs on Vercel ensuring a robust and scalable hosting environment
MongoDB is used to handle user data; MongoDB provides secure as well as flexible databases for storing complaints, feedback, and related metadata.
Multimedia files from users, including photographs and video files, are stored in AWS S3 buckets. This is an efficient and reliable method of file storage.

AI-Powered Modules:
Complaints with images and videos are processed by Advanced Multimodal Generative AI that, through image recognition and analysis, classify and prioritize complaints.
Text from multimedia is handled by LangChain - a powerful text processing workflow management tool.
Urgent complaints are screened by AI models that analyze content and determine priority status according to the acuteness of the problem.

Live Support:
A chatbot, through LLMs, engages users in the process to accept complaints, solicit more information, and give updates.
By doing this, users receive instant feedback and support while their complaint is registered.

Integration and Routing:
The platform implements intelligent routing of complaints by the departments using AI-based algorithms, thus providing faster resolution times.

Analytics and Insights:
The platform creates actionable insights from trends and patterns for predictive maintenance and resource optimization, thus analyzing complaint data trends and patterns for further actions.
Monitoring system performance increases accuracy, speed, and user satisfaction with continuous improvements.

PROPOSED SOLUTION

Gantavya is a holistic, intelligent platform that aims at automating much of the tedious work involved in handling railway complaints, thereby improving overall efficiency. The platform addresses the core challenges in the following ways:

1.Streamlined Complaint Categorization:
The AI analyses the content of complaints, be it in text, images, or videos.
Advanced multimodal AI examines images or videos submitted by passengers and categorizes complaints into predefined categories such as cleanliness, maintenance, or staff behavior.

2.Issues are prioritized
Critically, the system will evaluate the urgency of each complaint. For example, an image showing a safety hazard is flagged for immediate attention while those less critical are queued appropriately.

3.Data Extraction Improved
The Optical Character Recognition extracts text that is embedded in images or a document for the system to understand information like signage, ticket details, or written notes.
Capture metadata such as location and time as well as the file type to provide context in the complaint resolution.

4.AI-Powered Chatbot Interaction
The chatbot responds to the user in real time, acknowledging their complaint, then following through the submission process.It gathers relevant information from users, reduces manual intervention, and ensures that all information needed is gathered upfront.

5.Streamlined Complaint Routing:
Content analysis helps in routing complaints directly to the department or personnel who can resolve it, thus minimizing delays due to manual categorization and assignment.

7.Proactive Maintenance Through Prediction:
It analyses the pattern of complaints identified and predicts recurring problem areas
This enables railway authorities to anticipate problems and act accordingly to prevent future grievances.

8.User Feedback and Sentiment Analysis:
Feedbacks from users are analyzed to measure satisfaction and points for improvement.
The platform keeps improving and changing upon user input and the operational data with time in order to ensure a better experience over time.

9.Scalability and Integration:
Gantavya is designed to seamlessly integrate and infuse into the existing setup of Rail Madad. Its scalable architecture means that it can handle a growing number of complaints as the user base expands.

This intelligent, user-centric approach ensures that complaints are addressed quickly and effectively, improving both passenger satisfaction and operational efficiency for railway services.

CHAPTER 4: METHODOLOGY

The approach for developing Gantavya focuses on creating an AI-driven platform aimed at resolving inefficiencies in the current complaint management system for Indian Railways. This method integrates advanced technologies with structured processes to provide a scalable and user-friendly solution. Below is a comprehensive explanation of the methodology, articulated in a more approachable manner:

Step 1: Identifying the Issue

The initial phase involved a thorough examination of the current complaint management systems, like Rail MADAD and the IRCTC website. By analyzing how complaints are processed—from the moment they are registered until they are resolved—we pinpointed several issues, including slow classification of multimedia complaints (such as photos and videos) and insufficient real-time support. Feedback from passengers further illuminated specific challenges users encounter, enabling us to customize the system to effectively tackle these issues.

Step 2: System Design and Framework

A scalable, user-centric system layout was crafted to guarantee seamless operations. The architecture was segmented into several essential parts:

Frontend Development: The user interface was developed using Next.js for a fast, responsive, and mobile-friendly layout. Tailwind CSS was utilized for styling, enhancing its visual appeal and ease of navigation.

Backend Development: The backend was structured for optimal data processing and complaint management. MongoDB was selected for its versatility in managing both structured and unstructured data, while AWS S3 was incorporated for the secure storage of multimedia files.

AI Integration: The system design included AI modules that categorize and prioritize complaints based on user-submitted text, images, and videos, thereby minimizing manual intervention and enhancing classification accuracy.

Step 3: AI-Driven Complaint Management

Image and Video Analysis: We employed advanced multimodal AI models to assess visual content submitted by users. For example, images showing dirty coaches or broken infrastructure were automatically classified into specific complaint categories.

Textual Analysis and OCR: Written complaints or text extracted from images using Optical Character Recognition (OCR) were examined to grasp the nature of the issues raised. This allowed us to derive useful information from uploaded tickets, signs, or documentation.

Urgency Detection: Our AI models were trained to recognize the seriousness of complaints. For instance, safety-related issues were classified as high-priority, ensuring they received prompt attention from the appropriate department.

Step 4: Chatbot Integration

A chatbot, powered by Large Language Models (LLMs), was integrated as the initial contact point for users. Its functionalities include:

Confirming the complaint and providing reference IDs.Gathering additional information through engaging inquiries.Delivering real-time updates on the status of registered complaints.The chatbot guarantees users a smooth and interactive experience, minimizing the need for manual support in the initial stages.

Step 5: Intelligent Routing and Prioritization

Once a complaint is submitted, AI algorithms evaluate its content and direct it to the relevant department or official responsible for resolution. The intelligent routing system accounts for factors such as complaint type, urgency, and location, optimizing the process. High-priority complaints are highlighted for immediate action.

Step 6: Data Analysis and Predictive Maintenance

Trend Analysis: The system continuously monitors complaint data to identify recurring issues, like frequent cleanliness complaints concerning coaches or ongoing technical failures.

Proactive Responses: By utilizing predictive analytics, the platform assists railway officials in addressing potential concerns before they escalate, improving operational efficiency and reducing overall complaints in the long run.

Step 7: Feedback Management and Ongoing Learning

User Feedback Analysis: After resolving a complaint, users are invited to share their feedback. This input is analyzed using AI-driven sentiment analysis tools to assess satisfaction levels and identify areas requiring enhancement.

Model Updates: The AI models are routinely updated with new data to refine their precision and adjust to changing passenger preferences.

Step 8: Testing and Launch

Thorough Testing: The system underwent rigorous testing to ensure it functioned correctly across diverse scenarios, including the handling of complex multimedia complaints and addressing chatbot inquiries.

Deployment on Vercel: The completed system was launched using Vercel, offering a stable and scalable hosting solution that allows users to access the platform effortlessly.

Step 9: Scalability and Ongoing Enhancements

The platform was designed with scalability in mind, enabling it to accommodate growing user demands over time. Additionally, a feedback loop was established to track system performance and incorporate improvements based on user input and operational insights.

GITHUB's file:

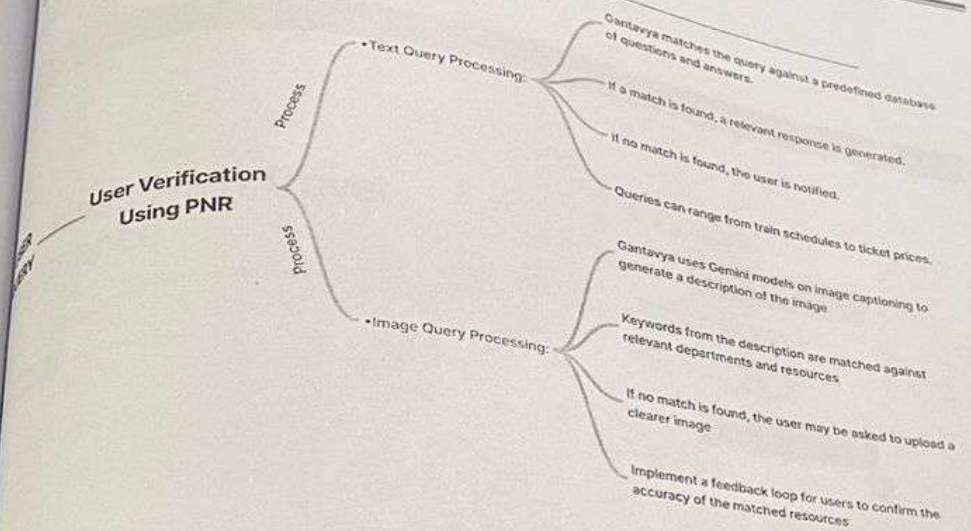
yugal1107 DONE ✓

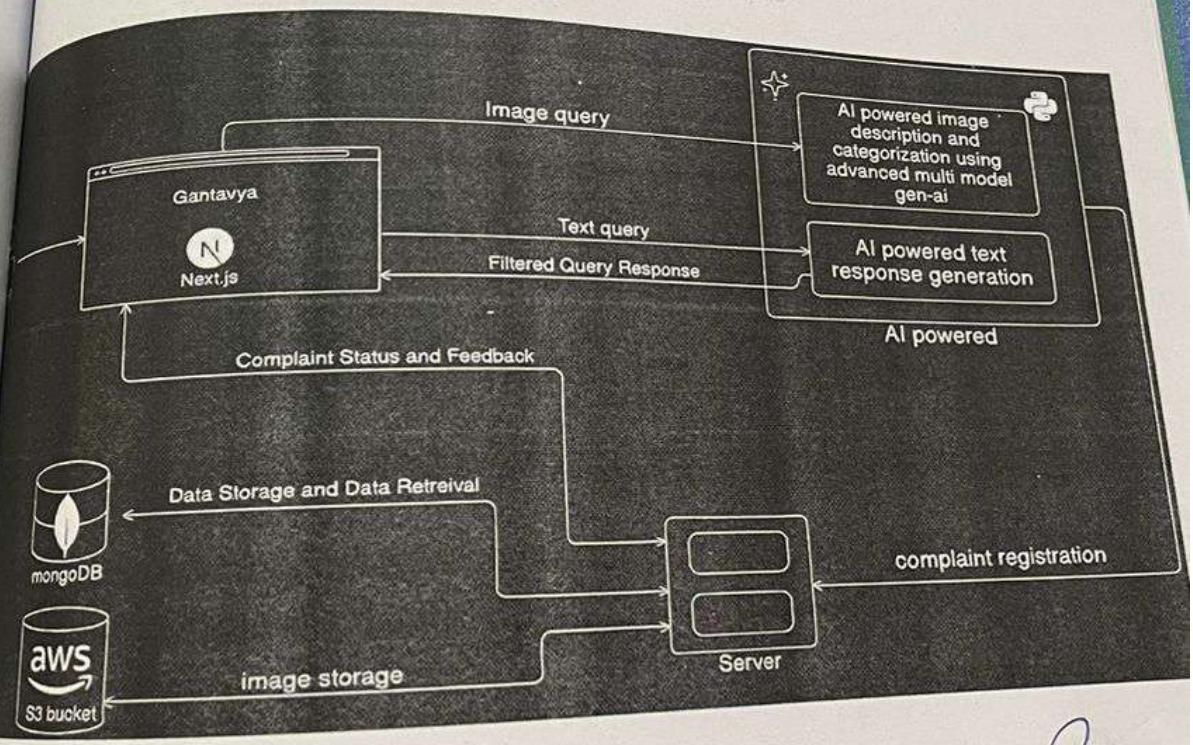
public	Some UI changes and integration of complaint registration u...	8 Commits
src	DONE	2 months ago
.env	Making chatbot work properly	2 months ago
.eslintrc.json	Some changes , improvement and routing by Yugal	2 months ago
.gitignore	Some changes , improvement and routing by Yugal	2 months ago
README.md	first commit	2 months ago
components.json	Some changes , improvement and routing by Yugal	2 months ago
jsconfig.json	Some changes , improvement and routing by Yugal	2 months ago
next.config.mjs	Some changes , improvement and routing by Yugal	2 months ago
package-lock.json	Prototype completed successfully	2 months ago
package.json	Prototype completed successfully	2 months ago
postcss.config.js	Prototype completed successfully	2 months ago
postcss.config.mjs	Some changes , improvement and routing by Yugal	2 months ago
tailwind.config.js	Prototype completed successfully	2 months ago

Describe your Technology stack here:

Python , NEXT.js , Tailwind CSS, MongoDB, JavaScript, AWS Bucket , Lang Chain , Advance Multimodal Gen Ai

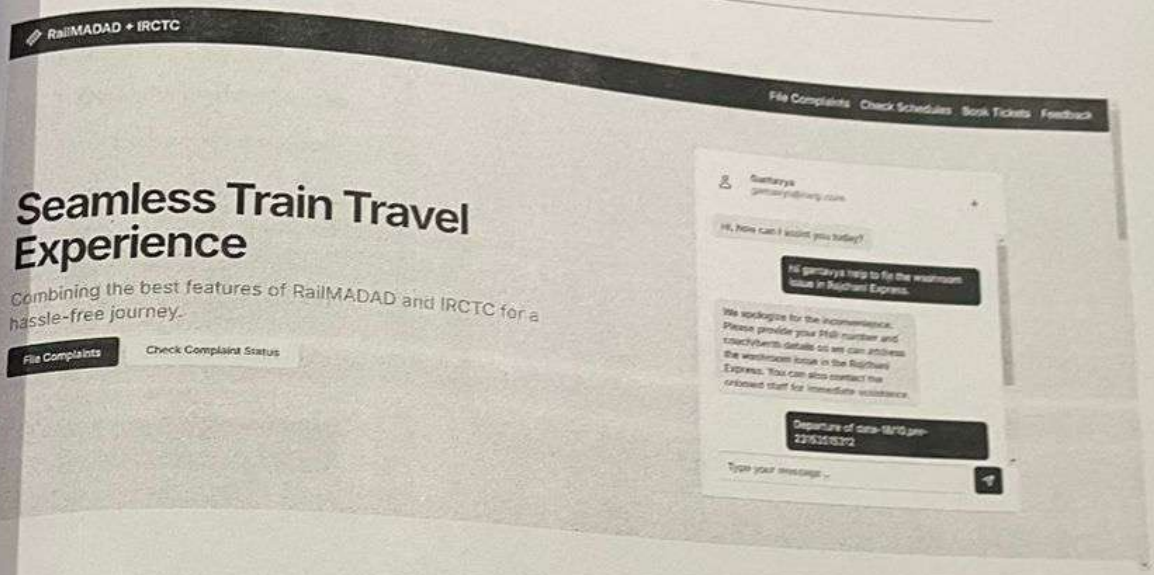
CHAPTER 5: WORK FLOW DIAGRAM



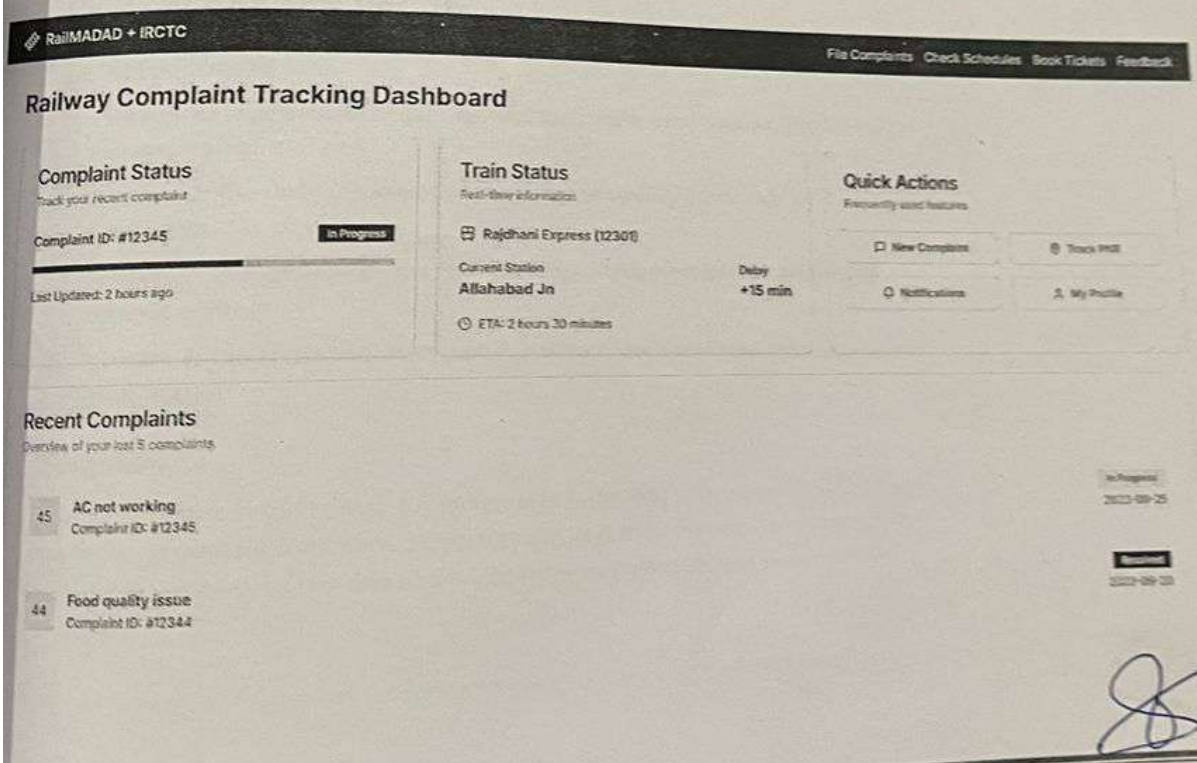


Chapter 6: Snapshots

Dashboard with Chatbot:



Railway Complaint Tracking Dashboard:



Complaint Registration via Image :

Analyze Railway Passenger Area

Railway Passenger Area Image

Choose File download (22).jpg

Analyze Railway Area

Railway Analysis Results

Detected Problems

- **Problem 1:** Large amount of garbage and food waste strewn across the floor of the passenger area. (Garbage)
- **Problem 2:** The sheer volume of trash creates unsanitary conditions for passengers. (Cleanliness)
- **Problem 3:** The garbage on the floor presents a tripping hazard, especially for children. (Safety)
- **Problem 4:** The accumulation of garbage attracts pests and creates an unpleasant smell. (Other)

Summary

The primary issue in this railway passenger area is the excessive amount of garbage, leading to unsanitary conditions, safety hazards, and an unpleasant environment for passengers. Immediate cleaning and improved waste management practices are necessary.

Other Features:

IRCTC integration

Seamless Ticket Booking

Easily book train tickets with our IRCTC integration. Manage your bookings and view your travel history.

Book Tickets | Train enquiry & Schedule

RailMADAD integration

Seamless Railway Logistics Solutions

Effortlessly send, track, and manage your parcels and freight with ease.

Railways Freight Services | Railways Parcel Services

Feedback Page:

RailMADAD + IRCTC

File Complaints | Check Schedules | Book Tickets | Feedback

RailRoad

Feedback | Details | Support

Send Feedback

Let us know how we can improve your experience.

Name

Enter your name

Email

Enter your email

Feedback

Share your feedback

Rating

☆ ☆ ☆ ☆

Submit Feedback

App Details

Learn more about the RailRoad mobile app.

Version

2.5.1

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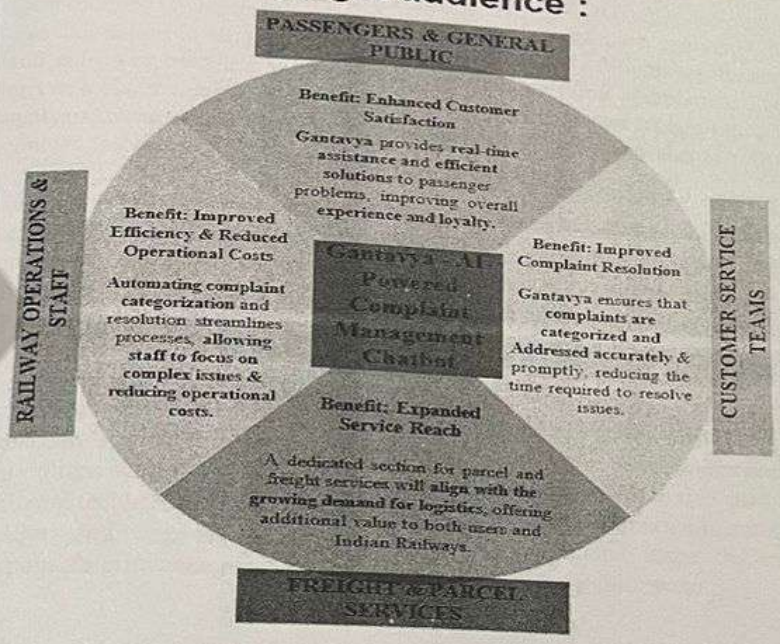
Features

- ✓ Real-time train schedules
- ✓ Ticket booking and management
- ✓ Push notifications for delays and updates

Potential Impact & benefit On The Target audience :



Future Scope:

The platform - Gantavya - has a lot of potential for further development and expansion. Future enhancements of the system could, for instance, focus on building more intelligence by integrating additional AI capabilities, like strong sentiment analysis for feedback or even more precise urgency detection. Second, the platform can be enhanced to accommodate multiple languages, so that the reach can get extended to more people across India.

Integration with other railway services like ticketing and booking systems and live train tracking would make Gantavya a solution that would cater to all needs of the passenger. It would also aid railway authorities proactively in addressing issues concerning the infrastructure itself before such become grave problems, allowing them to curate overall efficiency and safety of passengers.

With ongoing advancements in AI and cloud technologies, Gantavya can evolve into a scalable, smart, and indispensable tool for the Indian Railways, setting a benchmark for complaint management systems worldwide.

CHAPTER 8: RESULT/CONCLUSION

The Gantavya platform effectively tackles the main issues present in the current Rail Madad grievance handling system by employing advanced AI solutions and contemporary web technologies. By automating the classification of complaints, analyzing diverse media inputs, and facilitating intelligent routing, the platform greatly diminishes the need for manual effort and enhances both the accuracy and speed of resolving complaints. The integration of AI-driven tools, including image recognition, optical character recognition (OCR), and sentiment analysis, ensures that complaints are managed with a comprehensive understanding of their context and urgency.

Furthermore, the real-time chatbot feature improves user engagement by delivering instant acknowledgments, updates, and responses to passenger inquiries. The incorporation of predictive maintenance also helps identify persistent issues, enabling proactive strategies that minimize service interruptions and enhance overall railway functions. The system's scalable design, constructed with Next.js, MongoDB, and AWS S3, guarantees efficient handling of high volumes of complaints while remaining adaptable to future needs.

In summary, Gantavya presents a game-changing solution that boosts the effectiveness, precision, and user experience throughout the complaint resolution process. The platform not only aligns with the goal of modernizing railway services but also establishes a standard for utilizing technology to address real-life challenges. By emphasizing automation, user-focused design, and ongoing enhancement, Gantavya sets the stage for more intelligent and responsive grievance management systems within the public sector.

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SELF-EVALUATION OF PROJECT

Month	Start date – End date (DD/MM/YY) - (DD/MM/YY)	Progress of Project
Month- 1	05/08/24 - 31/08/24	Topic selection
Month- 2	01/09/24 - 30/09/24	Tech study and work flow discussion
Month- 3	01/10/24 - 31/10/24	Development for responsive website
Month- 4	01/11/24 - 18/11/24	Debuging and deployment

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