Smart Grievance Handling System Based on NLP and OCR

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***Abstract*—Grievance redressal is an important for good governance because it helps in solving people's complaints in a proper way. When the system works well, it gives trust between the public and the government. But in the current system, most of the petitions are handled manually, which creates a lot of problems like delays, wrong routing of complaints, and lack of accountability. Because of this, people may lose trust in the system. To solve these issues, we are proposing an AI-based grievance redressal system. In our system we use Natural Language Processing to understand and process the complaints that was given by users. We are using the RoBERTa model, this helps in understanding the meaning of the text and extracting important details from the complaint. Also, many petitions can be handwritten and scanned; we are using TrOCR to convert the image-based complaint into text. The processing of complaint was done, then the system will classify the complaints and send them to the correct department using techniques like text classification and NER. We are also providing an admin dashboard to manage all the complaints easily and an analytics dashboard to view reports and insights. This system makes the process faster, more accurate, and more transparent.**

***Keywords*— Named Entity Recoginition (NER), Natural Language processing (NLP), Roberta (Transformer for NLP), Tokenization, TrOCR**

I. INTRODUCTION

The Public grievances is very important for improving governance because it gives people a chance to say their problems and get proper solutions. When complaints are solved correctly it builds trust between citizens and government. But in the current system everything was done manually, which makes the process slow and delays. It has issues like wrong routing of petitions, delays in response, and lack of updates and this reduces people's confidence in the system. With the growth of Artificial Intelligence and Natural Language Processing, there is a better way to handle these problems. These technologies can understand human language and meaning more accurately. So, in this project, we are developing an AI-based grievance redressal system to make the process faster and more efficient. Our system uses the RoBERTa model to
understand and analyze the complaint text. We are also using TrOCR to convert handwritten or scanned petitions into digital text. After processing the input, the system uses intent detection and Named Entity Recognition (NER) to identify the type of complaint and send it to the correct department automatically, reducing manual work. We also added features like real-time tracking, notifications, and reminders to respective department officials. So that users can track their complaints. An Admin Dashboard is builded to manage and monitor all the grievances, and an Analytical Dashboard helps in viewing weekly or monthly reports by using data visualization. The system gives 85% accuracy, which makes it reliable for practical use. The system helps grievance handling faster, more transparent, and easier for citizens as well as officials, improving the governance process.

II. LITERATURE SURVEY

The complaint classification and grievance handling has improved a lot by using the technologies like NLP, machine learning, and deep learning. Before, most systems were manual, that made the process slow, less efficient, and not very transparent. Because of these

issues, many researchers started using AI to improve the system. More research papers like IEEE, have contributed to this field. They focus on things like classifying complaints, routing the complaints to the correct department, converting scanned documents into text using OCR, and improving text classification methods.

"NLP Based Model for Classification of Complaints: Autonomous and Intelligent System" by Qurat ul Ain, A. Shaukat, and U. Saif, published in 2022. They focus on building a system using AI and NLP techniques to automatically classify complaints given by citizens. Their focus is to make the process faster and reduce manual work. They mention that the performance of the system depends on having a good labeled dataset. Without proper dataset, the accuracy of the model will affect the result.

"Automated Complaint Classification and Routing Using NLP and Machine Learning" by Anurag Saha and team (2024). They explain how complaint handling can be automated using NLP, machine learning, and deep learning techniques. They compare the models like dataset, performance, scalability, efficiency and they are good for the practical use. The deep learning helps improve the routing of complaints to the correct department. But these improvements is not enough for well working of the system, need some other techniques for the improvement.

"TrOCR: Transformer-Based Optical Character Recognition with Pre-Trained Models" by Minghao Li and team (2021). They use an OCR system based on transformer models, they use Vision Transformer with a transformer decoder to recognize/identify text from images. The model works well for both printed and handwritten text and gives good accuracy; this gives the strength of transformer-based approaches. There is a drawback that it requires more computational power, this can be a challenge in some cases.

"Consumer Grievance Handler" by G. Shobana and team (2022) worked on reducing the difficulty of handling large complaints manually. They developed a machine learning- based model to classify complaints and also used sentiment analysis to decide the priority of the complaints. This system helps for real-time complaint submission and classification using Python Flask API, helps for practical use. It has limitation that is the system is not very flexible to use in different domains or use cases.

"HTR-VT: Handwritten Text Recognition with Vision Transformer" by Yue Wang and team (2024) explains the transformer models and how it is used for handwritten text recognition. They avoid using traditional CNN-RNN models instead of that they use a self-attention mechanism in transformers to improve accuracy. This method gives a better result for recognizing handwritten text and it is useful for real-world applications like reading scanned petitions. Its use in grievance redressal systems is still not very widely explored.

According to IEEE literature discussed above, there are some developments in complaint classification, routing, and document digitization using AI and transformer models. There are still challenges to be overcome efficiency and computational complexity. This project is based on the developments of transformer models for NLP, OCR technology such as TrOCR, and routing mechanisms to develop a grievance redressal system for improved efficiency, transparency, and citizen participation.

III. PROPOSED WORK

The proposed system "AI-powered grievance redressal platform" is designed to handle complaints in a fully automated way from submission to resolution. The goal is to make the process faster and more efficient for both citizens and officials. We use Natural Language Processing and transformer-based models like RoBERTa to understand and process the complaints. It helps for text preprocessing, understanding the meaning of the complaint, classifying it, detecting intent, and extracting important details using NER. The system can clearly understand what the user is trying to say. We also use TrOCR to convert handwritten or scanned petitions into digital text. This helps in handling both image based and digital complaints easily.

The application was build using frontend and backend technologies that make it easy to use. We used Flask for connecting Frontend with backend and it also handles the logic of the system. For the frontend we use HTML, JavaScript and Tailwind CSS to create a clean and user-friendly interface. The users can sign up first, then submit their complaints, and also track the status of their complaint in real time. JavaScript is used to add features like notifications and progress updates and Tailwind CSS helps in designing the interface nicely. For the officials there is an Admin Dashboard where

they can monitor and manage all the complaints easily. The NLP model was used in the backend for processing the complaints automatically and sends them to the correct department, this improves transparency and accountability. The system also supports written text complaints; this is useful for a larger group of people. We also designed an Analytical Dashboard that shows data in the form of charts and reports, this helps in better understanding and decision-making.

Thus, the AI-based grievance redressal system uses different technologies like transformer-based NLP, TrOCR for document/image-based complaint processing, and automatic complaint classification with their respective departments and also has a tracking system. The frontend is built using HTML, JavaScript, and Tailwind CSS and the backend uses Flask to handle all the processing. Compared to the traditional manual system this approach is faster, efficient and easier to manage. It also improves transparency and makes the system more user-friendly. This project provides a scalable and automated solution for handling grievances in a better way.

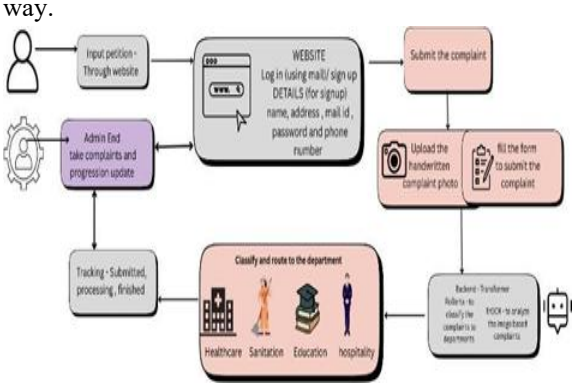

Fig no.1 Architecture Diagram

MODULES:

1. Data collection and Preprocessing
2. Image-Based Complaint Processing using TrOCR
3. AI analysis and department classification
4. Automated Complaint Routing
5. Grievance Dashboard and Analytics

Data Collection and Preprocessing

The "Data Collection and Preprocessing" module helps with collecting grievance data from real time datasets or past complaint records. The collected data will have many unwanted things like stop words, special characters, or irrelevant information, this will be said has noise. In this phase we will preprocess all the collected data by cleaning the data like removing the noise data. We use some techniques to reduce and clean the data like tokenization, lemmatization, and normalization for the meaningful text and easy to process. Then the raw grievance data is converted into a structured format, this helps the system to understand and analyze the complaints better.

AI Analysis and Department Classification

In this module the complaint given by the user is analyzed/processed using a transformer-based NLP model like RoBERTa. The model helps in understanding the actual meaning and context of the complaint. After analyzing the complaint, the system can understand the complaint easily, then the system classifies the complaints into the correct departments like sanitation, healthcare, education and hospitality. This will make sure that the complaint was send to the right department without any confusions and delays.

Image-Based Complaint Processing using TrOCR

This module will allow the system to process grievances in the form of images or handwritten documents. Users will be able to upload the scanned or photographed complaints via the system's interface. The TrOCR (Transformer-based Optical Character Recognition) model will read the text from the uploaded images and convert it to digital text. The extracted text will then be sent to the AI analysis module.

Automated Complaint Routing

This module is responsible for sending the complaints to the correct department automatically it does not need any manual work.We have integrated AI in this module for forwarding each complaint to the appropriate department. This helps for checking the complaint reaches the right department without any manual work. This process becomes faster and reduces the chances of mistakes by this module.

Grievance Dashboard and Analytics

The dashboard analysis module gives a user-friendly interface for viewing and analyzing all the grievance data that are recorded in the system. This dashboard shows important details like the total number of complaints received, how many are resolved, how many are in process, and how the complaints are distributed across different departments. This helps the

authorities to understand the overall situation clearly like how fast the complaints are resolving, how much accuracy it reaches monthly, according to this it take better decisions. It also improves transparency. Using this module, officials can easily check and analyze the grievance system performance.

IV. MODEL EVALUATION AND ACCURACY

1. Test Loss: 0.167

The test loss measures the error rate associated with the predictions made by the model on the test data. Low test loss means the model has learned the patterns correctly.

2. Test Accuracy: 90%

The accuracy of the model on the test data is high, i.e., 90% of the instances in the test data have been classified correctly.

V. RESULT

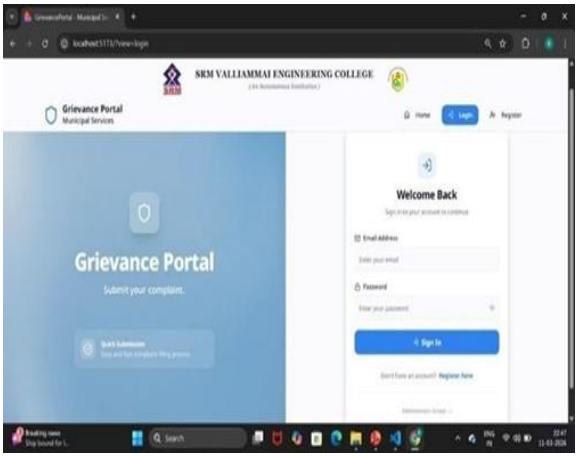

Fig no. 2 login page

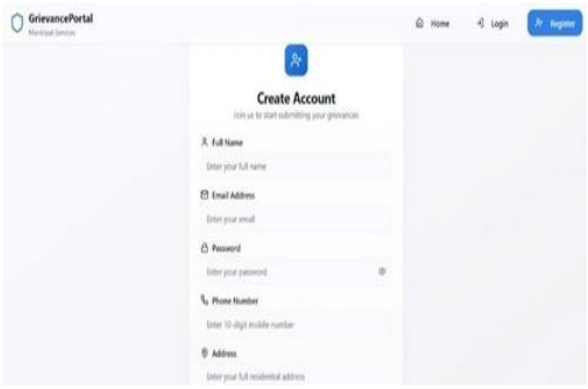

Fig no.3 sign up page

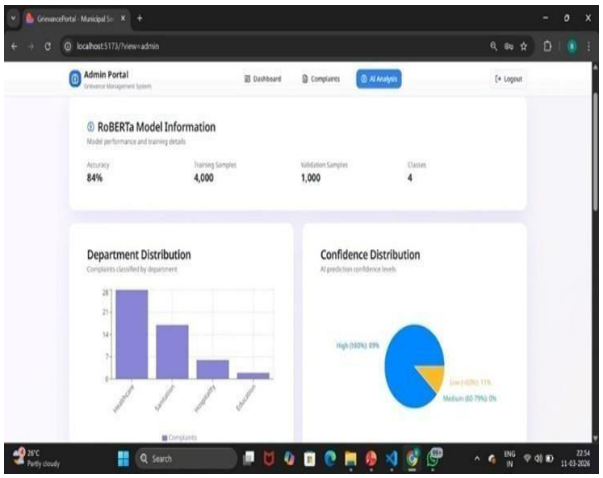

Fig no.4 complaint registration page

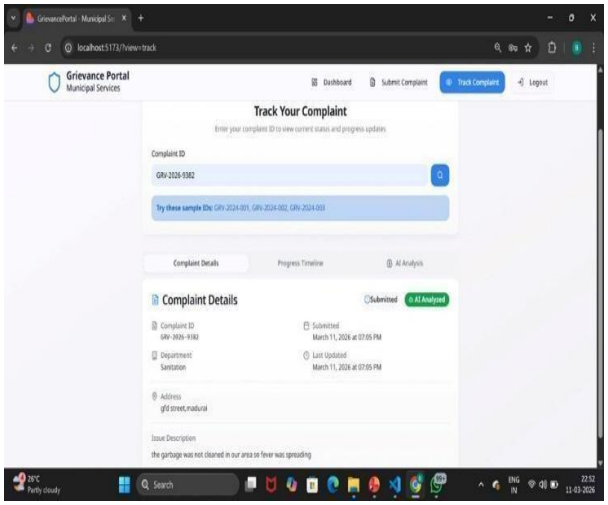

Fig no.5 Tracking page

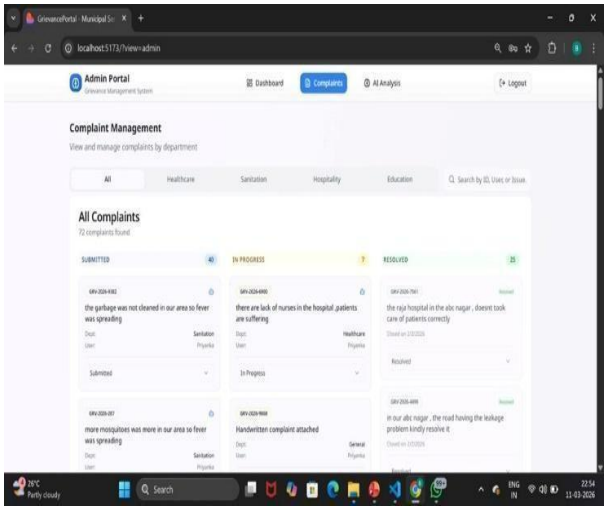

Fig no 6 Admin dashboard

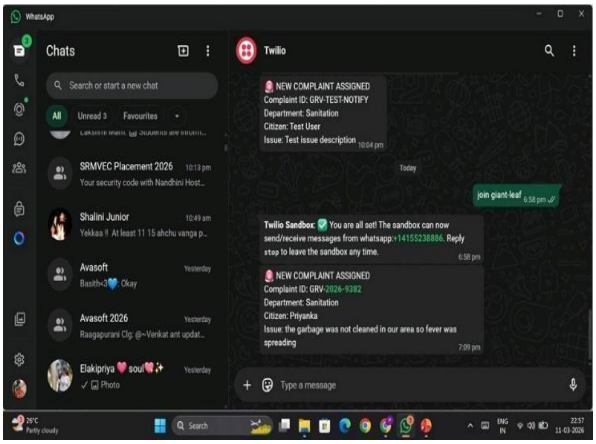

Fig no.7 WhatsApp notification to admin

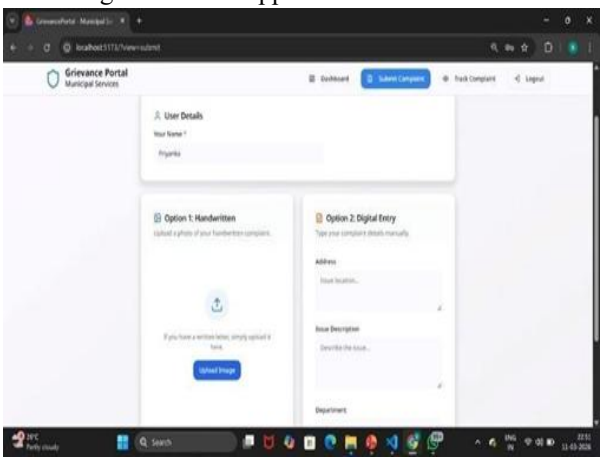

Fig no.8 AI analysis Dashboard

VI. CONCLUSION

The proposed "AI-based grievance redressal system" tells how NLP and transformer models like RoBERTa can be used for the automated tasks like analyzing, classifying, and routing complaints to the appropriate departments. By using TrOCR we can handle scanned and handwritten complaints easily and it supports the text and image-based inputs. Analyzed complaints helps for better understanding of text and automatic routing this will helps the system for reducing manual work, improves speed, and increases transparency. It has real-time tracking and the Admin Dashboard help officials to monitor all the complaints easily and maintain the complaints according to the departments. The Analytical Dashboard helps in understanding the data by visualization methods like charts and reports this supports for better decision-making. We used Flask for system backend and HTML, JavaScript, and Tailwind CSS for frontend, this makes it simple and user-friendly system for people to submit and track their complaints. This system is a scalable and efficient solution for modern grievance handling. In future, this system can be improved by adding advanced features like voice-based complaint handling, support for multiple languages, chatbot based complaint system and better model accuracy using more data. Adding explainable AI can make the system more transparent, and deploying it on cloud can support large-scale usage. These improvements can make the system more useful and impactful in real-world governance.

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