The AI-Based Complaint Classification System

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ABSTRACT

The AI-Based Complaint Classification System is designed to analyze and categorize user-submitted complaints using Natural Language Processing and machine learning techniques. Traditional complaint management systems rely heavily on manual processing, where complaints are reviewed and categorized by human operators. This often leads to delays, inconsistencies, and inefficiencies, especially when handling large volumes of complaints.The proposed system provides a web-based platform where users can submit complaints in text format. These complaints are processed using a structured pipeline consisting of text preprocessing, feature extraction using TF-IDF, and classification using machine learning algorithms. The system converts unstructured complaint data into structured information by identifying the appropriate category such as Theft, Billing, Technical Issues, Infrastructure Problems, and Public Safety.The classified results are stored in a database and displayed through a user interface, enabling efficient tracking and management of complaints. This approach reduces manual effort, improves classification accuracy, and enhances the speed of complaint processing. The system demonstrates how artificial intelligence can improve complaint management systems by enabling automated decision-making and efficient data handling.

INTRODUCTION

Complaint management plays a crucial role in improving service quality and ensuring customer satisfaction in both public and private sectors. Traditional complaint handling systems rely on manual processes, where complaints are received, analyzed, and categorized by human operators. This approach is time-consuming and often leads to inconsistencies due to human error.With the increasing volume of complaints in modern systems, manual processing becomes inefficient and difficult to scale. Complaints are usually submitted in unstructured text format, making it challenging to analyze and categorize them accurately. This creates delays in response and affects overall service

quality.With advancements in artificial intelligence and web technologies, it is possible to automate the process of complaint classification. The AI-Based Complaint Classification System provides an intelligent solution where users can submit complaints through a web interface. The system automatically processes the complaint using machine learning techniques and categorizes it into predefined classes.The system uses Natural Language Processing to analyze the input text and convert it into numerical form using TF-IDF vectorization. A trained machine learning model then predicts the category of the complaint. This structured output helps in efficient complaint handling, reduces manual effort, and improves decision-making.

EXISTING SYSTEM

The existing complaint management system primarily relies on manual processes where users submit complaints through forms, emails, or customer service platforms. These complaints are then reviewed and categorized by human operators before being forwarded to the appropriate department.In most cases, the classification of complaints depends entirely on human interpretation, which can vary from person to person. This leads to inconsistencies and errors in categorization. Additionally, the process is time-consuming, especially when handling a large number of complaints.Traditional systems store complaint data in unstructured formats, making it difficult to analyze trends and patterns. There is no automated mechanism to process text data and extract meaningful insights. As a result, organizations face delays in resolving issues and managing complaints efficiently.

DRAWBACKS FOR EXISTING SYSTEM

The existing system has several limitations that affect its efficiency and performance.One major drawback is the dependency on manual processing, which increases the time required to handle complaints. Human operators must read and understand each complaint individually, which slows down the process.Another limitation is inconsistency in classification. Different individuals may interpret the same complaint differently, leading to incorrect categorization.The system also lacks scalability, as it cannot efficiently handle a large volume of complaints during peak periods.Additionally, the absence of automated text analysis prevents the system from extracting useful insights and identifying patterns in complaint data.

PROPOSED SYSTEM

TThe proposed system introduces an AI-based approach to automate complaint classification using machine learning and Natural Language Processing techniques. Users can submit complaints through a web interface, and the system processes the input automatically to determine the appropriate category. The system performs multiple stages of processing. First, the complaint text is preprocessed by removing unwanted characters, converting text to lowercase, and eliminating stop words. Next, the processed text is transformed into numerical form using TF-IDF vectorization. A machine learning model such as Logistic Regression is used to classify the complaint into predefined categories such as Theft, Billing, Technical Issues, Infrastructure, and Public Safety. The model predicts the category based on patterns learned from training data. The results are stored in a database and displayed through a user interface. This enables efficient monitoring and management of complaints. The system reduces manual effort, improves accuracy, and ensures faster processing of complaints.

ADVANTAGES OF PROPOSED SYSTEM.

- Provides automated complaint classification, reducing manual effort
- Improves accuracy and consistency using machine learning
- Enables faster processing and response to complaints
- Converts unstructured text into structured data
- Supports real-time complaint handling
- Scalable and cost-effective solution
- Enhances decision-making through structured data

FEASIBILITY STUDY

Technical Feasibility

The technical feasibility of the AI-Based Complaint Classification System is high due to the use of well-established and widely supported technologies such as Python, Django framework, and machine learning libraries like Scikit-learn, Pandas, and NumPy. These technologies are open-source, regularly updated, and have strong community support, making development, debugging, and maintenance efficient.The system utilizes Natural Language Processing techniques to analyze text-based complaints, which can be effectively implemented using existing libraries without requiring complex infrastructure. The machine learning model uses TF-IDF vectorization and classification algorithms such as Logistic Regression to process and categorize complaint data accurately.The integration of the machine learning model with the Django backend ensures smooth interaction between user input, processing logic, and output generation. The system can be deployed

on local servers or cloud platforms such as AWS EC2, ensuring scalability and accessibility.The hardware requirements are minimal and can be handled by standard computing systems, making the implementation practical even with limited resources. Overall, the availability of tools, ease of integration, and compatibility across platforms make the system technically feasible.

Behavioral Feasibility

The behavioral feasibility of the system is favorable as it is designed with a simple and user-friendly interface that requires minimal technical knowledge. Users can easily submit complaints through a web-based form using natural language without requiring any specialized training.The system provides immediate feedback in the form of predicted complaint category and confidence score, which improves user understanding and interaction. The interface is designed to be intuitive, ensuring that users can quickly submit complaints without confusion or delay.For administrators or system users, the complaint viewing interface presents data in a structured format, making it easy to monitor, analyze, and manage complaints. As users are already familiar with web applications and digital platforms, the adoption of the system is expected to be smooth.The system builds trust by providing consistent and automated classification results, reducing dependency on manual interpretation and improving overall user experience.

Economic Feasibility

The AI-Based Complaint Classification System is economically feasible as it is developed using open-source technologies, which eliminates licensing costs. Tools such as Python, Django, and machine learning libraries are freely available, reducing the overall development expense.The system can be deployed using cost-effective solutions such as local servers or cloud platforms like AWS EC2, which offer scalable infrastructure and free-tier options for initial deployment. The maintenance cost is also low, as updates and improvements can be implemented without requiring expensive hardware or software.By automating the complaint classification process, the system reduces the need for manual labor, thereby lowering operational costs. It also improves efficiency, which indirectly contributes to cost savings in complaint management operations. Therefore, the benefits of the system outweigh the development and deployment costs.

Implementation:

The system is implemented using Python and the Django framework. Django is used to develop the backend and manage the web application, while handling user requests and responses.The machine learning model is developed using Scikit-learn, which provides tools for text processing and classification. The model is trained using labeled complaint datasets and stored as a serialized file for efficient reuse.The system uses a SQLite database to store complaint records along with their predicted category and confidence score. The application provides a user-friendly interface for submitting complaints and viewing results.The system supports real-time classification and ensures smooth interaction between frontend, backend, and machine learning components. The modular design ensures scalability, maintainability, and ease of integration.

METHODOLOGIES:

The system follows a structured multi-stage approach for analyzing complaint messages:

A. Text Preprocessing

The input complaint is cleaned by removing special characters, converting text to lowercase, and eliminating unnecessary words such as stopwords. This step ensures that the input data is standardized and improves the quality of text for further processing.

B. Feature Extraction

TF-IDF (Term Frequency–Inverse Document Frequency) is used to convert textual complaint data into numerical vectors. This enables the machine learning model to understand the importance of words and process the input effectively.

C. Complaint Classification

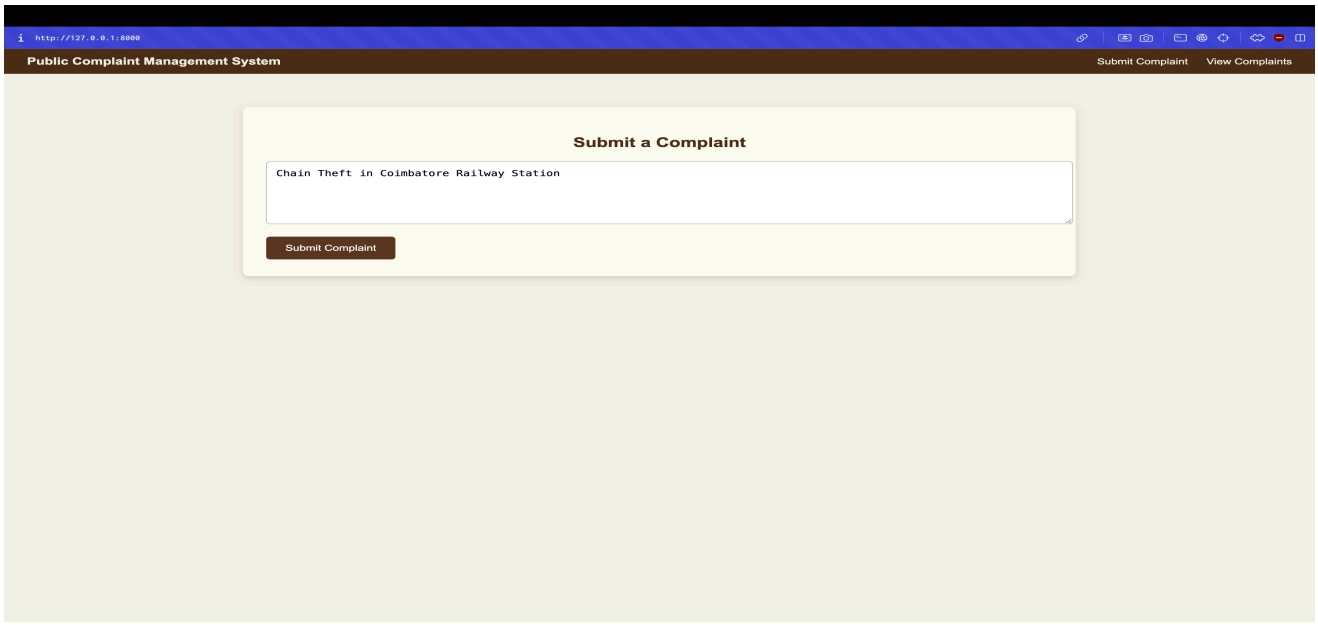
A machine learning classification model is used to analyze the processed input and categorize the complaint into predefined classes such as Theft, Billing, Technical Issues, Infrastructure, and Public Safety.

D. Confidence Score Calculation

The model calculates a confidence score representing the probability of the predicted category. This helps in understanding the reliability of the classification result

Results and Discussion:

The system successfully processes user-submitted complaints and generates structured outputs including predicted category and confidence score. The results are displayed through the user interface, providing immediate feedback to users.The use of machine learning significantly improves efficiency by automating the complaint classification process. It reduces manual workload and ensures consistency in categorization. The system enables quick identification of complaint types, which helps in better management and faster resolution.However, the accuracy of the system depends on the quality and size of the training dataset. Complaints with unclear or ambiguous text may affect prediction accuracy. Continuous improvement in dataset quality and model training can further enhance system performance.



User Module

```
curl -X POST http://127.0.0.1:8000/api/analyze/ \
-H "Content-Type: application/json" \
-d '{"complaint":"lost chain in railway station"}'
```

API Module

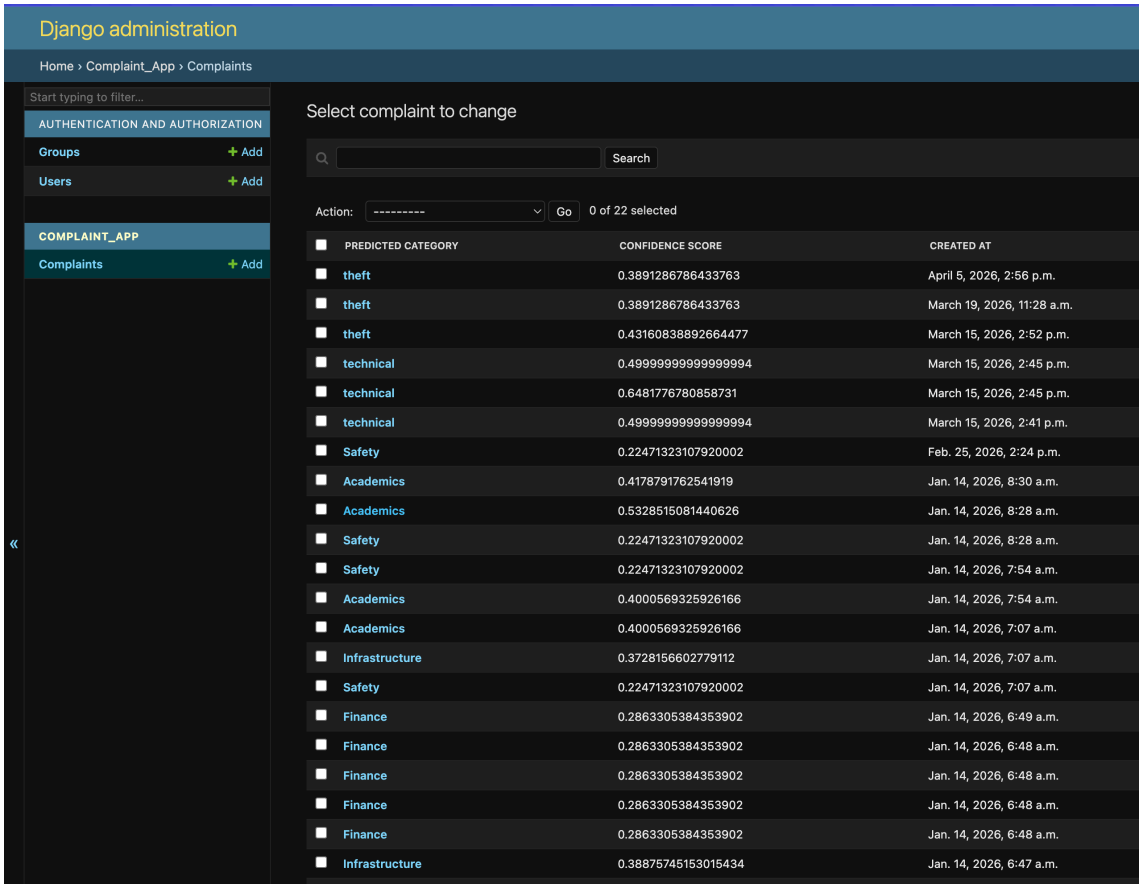
JSON

```
{
  "category": "theft",
  "confidence": 0.94
}
```

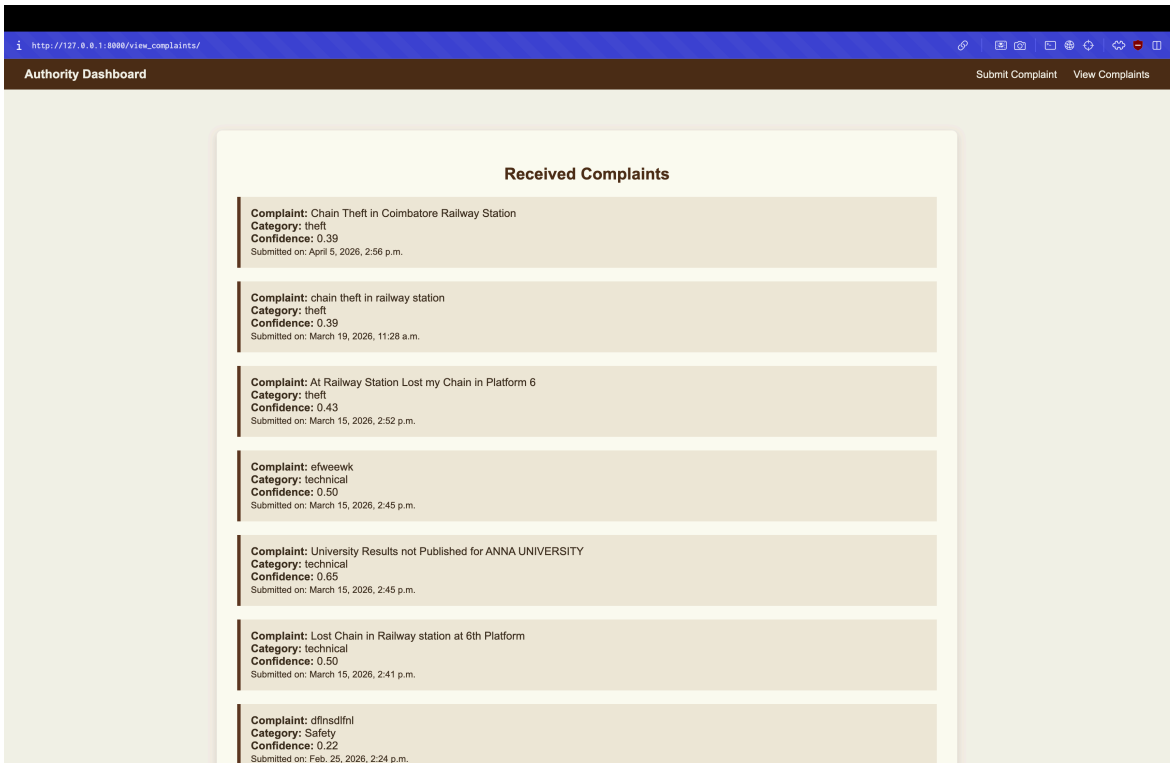
Api Module

```
Input Text
    ↓
Preprocessing
    ↓
TF-IDF Vectorization
    ↓
Model Prediction
    ↓
Category + Confidence
    ↓
Output
```

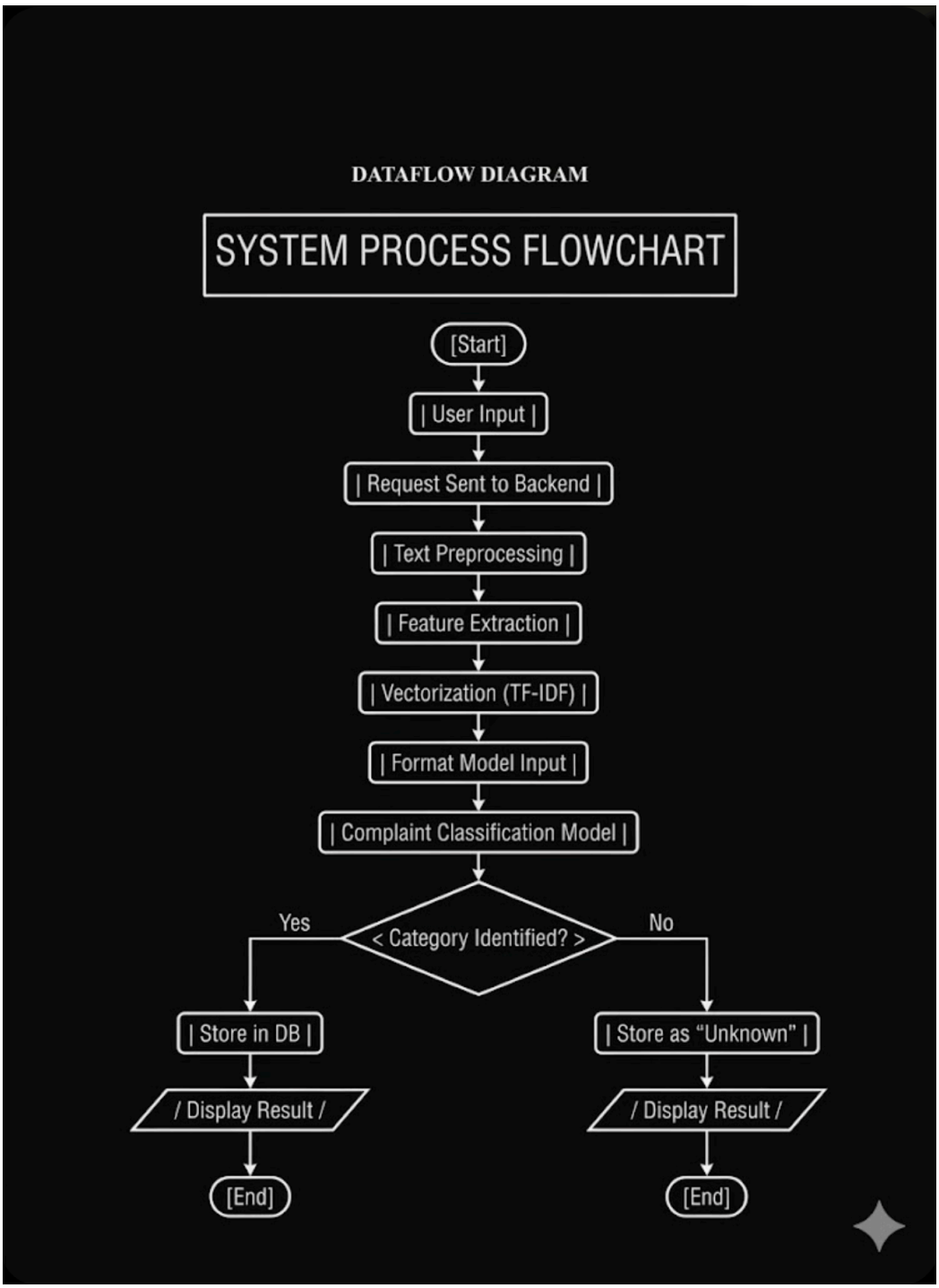
NLP Module



Database Module



Dashboard Module



Data Flow Diagram