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Intelligent Complaint Handling System using Machine Learning and Sentiment Analysis

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Abstract **- In the academic setting effective complaint management is a must which we do to address issues brought forward by students and staff across different fields. Presently we see that manual systems which we have in place are a cause of delay in terms of issue resolution and they also fall short in terms of which complaints get attention first which in turn leads to diss satisfaction. We present a smart complaint management system which puts in use AI tools like natural language processing and sentiment analysis for automatic complaint classification, determination of issue urgency and priority. The system also has an AI element which jumps in tool to report back complaints which are still open or very serious and we put in real time dashboards for admin and end users. We have here a college centered solution which greatly improves response time, accountability and operational efficiency.**

Keywords: **Complaint issue resolution, AI, Machine Learning, Natural Language Processing, Issue sorting out, Escalation, Sentiment analysis, Real time tracking, Process automation, User satisfaction.**

I. INTRODUCTION

In present day's fast moving and service oriented environment effective complaint management is a key to maintain user trust and organizational efficiency. Presently we see that traditional complaint handling systems do which is they delay response, they do poor job at priority setting and have broken down in terms of issue escalation. These issues result in issues which are left unresolved, low customer satisfaction and damage to reputation. To that end this project has introduced a Smart Complaint Management System which puts in to use Artificial Intelligence to0 automation and improve the complaint resolution process.

By using Machine Learning (ML) and Natural Language Processing (NLP) we have developed a system which smartly goes through the content of the complaints, determines which are the urgent ones and puts them at the top of the list. Also we have included an automatic escalation feature which sees to it that high priority or unattended to complaints are brought to the attention of the right authorities or departments.

Efficient complaint management is key to the quality of services we provide in organizations across Various fields such as government agencies, educational institutions, health care facilities, and private businesses. We see that which well designed complaint systems do a better job at reporting issues, giving feedback, and getting results which in turn produces higher levels of customer satisfaction and better service delivery. But also many present systems still use manual processes or out of date technology which in turn causes delays in response, poor management and a lack of transparency.

Traditional complaint systems do in fact present a number of issues including that of inconsistent complaint classification, no effective way to identify urgency, poor tracking, and also inadequate escalation.

II. OBJECTIVES

1. Use AI for classification and sentiment analysis.
2. Put in place priority determination and auto routing to the appropriate departments.
3. Better the user experience and reduce time to resolution.
4. Develop an automatic escalation for based on time or sentiment.
5. Also create an admin dashboard for live updates, reports.

III. LITERATURE SURVEY

[1] Gokce, Tajvidi, and Hajli (2024) report in a very in depth study which puts Artificial Intelligence and machine learning at the fore of improving how organizations respond to negative feedback. They present that which is very precise and tailored which includes things like owning up to mistakes, giving out direct contact info, and reporting what actions will be taken improves customer satisfaction and loyalty. Using large scale data sets their AI based framework is able to predict customer sentiment and inform in to the development of automatic complaint handling solutions which is the response of Personalization is a key element of effective engagement.

[2] In regards to task prioritization which Li et al. (2025) have also improved upon by presenting a Nash Q-learning model for the optimal dynamic decision in multi agent settings. They put forth a framework which does that for tasks' input into the system, taking into account urgency, system state, and

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available capacity which in turn reduces latency and increases adaptability. While it is mainly in the resource scheduling and technical fields they looked at, the model's approach may be applied tointelligent complaint management systems which require dynamic prioritization. Evolution of Object Detection (R-CNN → YOLOv8): R-CNN (2014) used selective search + CNN but took ~47s/image. Fast/Faster R-CNN (2015) added shared features and RPN, cutting time to ~200ms, but were still two-stage.

[3] Sarafis and Karamitsios (2024) present an overview of the evolution of citizen complaint management systems which see the shift from traditional to very advanced digital platforms. They report on how we went from manual to very integrated case tracking, automated routing and natural language processing which in turn has brought about very adoptable and scalable systems. In the area of AI they note that is is used in complaint classification and priority setting which in turn is a step towards the use of intelligent chatbots, real time feedback and predictive analytics in what they term public and e-government applications. OCR Techniques (Tesseract vs. EasyOCR): Plate OCR struggles with small, distorted, blurred crops. Tesseract (2005) uses LSTM but needs tuning. Du et al. (2017) found ~85–90% accuracy on clean images, worse otherwise.

Industry forecasts reveal rapid growth in the AI complaint management market, expected to reach USD 28.92 billion by 2033 at a CAGR of 21.1%, driven by the need for faster, more personalized, and multi channel support.

While these studies highlight the potential of AI to improve complaint management, common limitations persist. Many systems lack end-to-end integration, predictive escalation capabilities, and transparency in decision-making.

Summary: Existing literature underscores a significant shift from manual procedures to AI-enabled, automated solutions.

IV. SYSTEM ARCHITECTURE

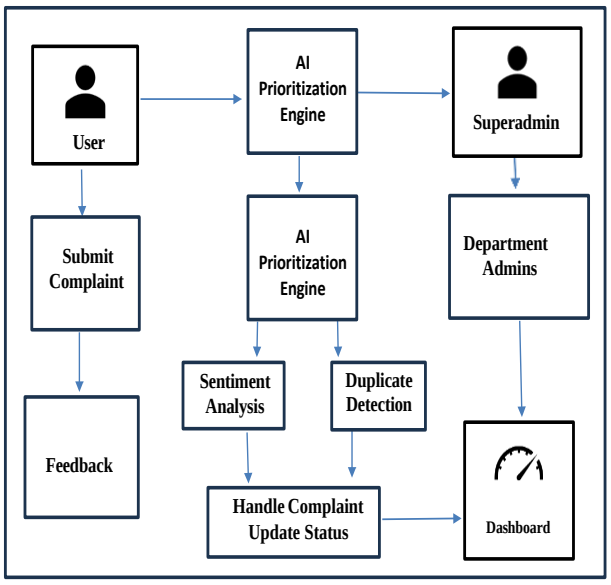

Fig. System Architechture

The architecture of the proposed system follows a three-tier design, consisting of the presentation layer, application layer, and database layer. The presentation layer provides an intuitive web and mobile interface through which users can register complaints, track their status, and receive real-time updates.

The application layer performs the core business logic, including complaint categorization, AI-based priority scoring, SLA (Service Level Agreement) tracking, and automatic escalation. It also handles authentication, authorization, and secure communication between components. The database layer securely stores all information, including user details, complaint data, priority scores, assignment logs, and escalation histories, using a relational database such as MySQL or PostgreSQL.

The system also includes administrative dashboards that offer data visualization tools for monitoring performance indicators such as average response time, open complaint count, and SLA compliance rate.

V. RESULTS & DISCUSSION

The developed AI-Based Complaint Management System successfully provides a centralized platform for managing departmental complaints efficiently.

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The web dashboard displays real-time complaint statistics, complaint status distribution, and priority analysis, helping administrators monitor and resolve issues effectively.

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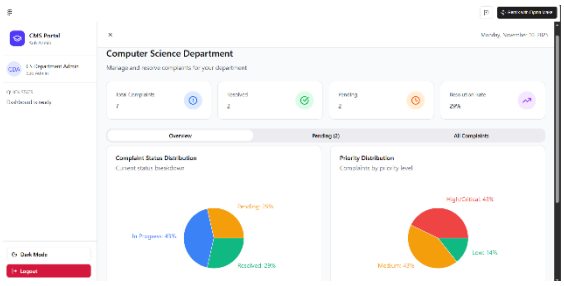

Fig. 2 Dashboard

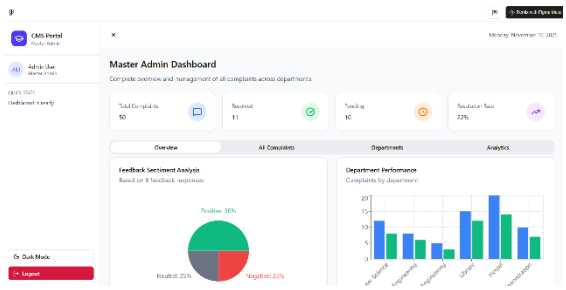

Fig. 4 complaint solving status

Discussion:

The implemented system improves complaint handling through automation and AI-driven prioritization. Compared to traditional manual complaint systems, the proposed solution provides:

- Faster complaint classification
- Better tracking and monitoring
- Automatic priority assignment
- Improved escalation handling

The result section of the AI-Based Complaint Management System demonstrates the effectiveness of integrating Artificial Intelligence with complaint handling and escalation management. The developed system successfully automates complaint processing, prioritization, and monitoring through a centralized web application.

VI. ADVANTAGES

a. AI-Based Complaint Classification.
b. Automated Prioritization and Escalation.
c. Real-Time Monitoring and Notification
d. User-Friendly Interface.
e. Security and Reliability.
f. Scalable and multi-platform compatible.

VII. WEB INTERFACE

The system provides a user-friendly web interface built using Flask. The following pages are included:

a. User Authentication & Authorization: User registration and login
b. Complaint Submission System: User Submit the complaints online
c. History: Displays historical records from the database.

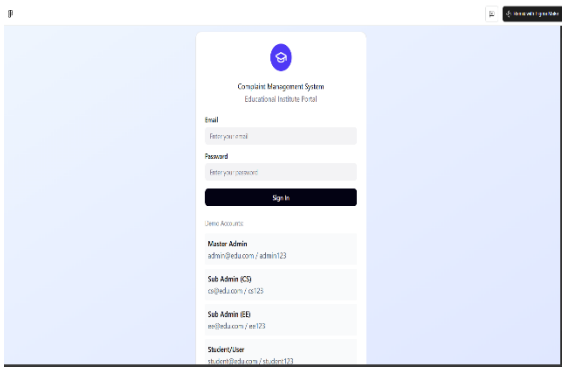

Fig. Page of Application

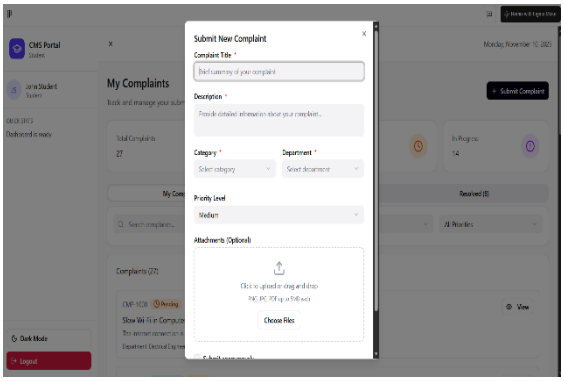

Fig. 6. History Page in Application

VIII. LIMITATIONS

a. AI Prediction Accuracy Limitation.
b. Dependency on Quality Data.
c. Language and Regional Limitations.

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IX. FUTURE WORK

a. Voice and Chatbot Integration.
b. Sentiment Evolution Tracking.
c. AI-Powered Resolution Suggestions.
d. Face recognition integration for enhanced security.

X. CONCLUSION

The Smart Complaint Management System with AI-Powered Prioritization and Escalation represents a transformative approach to managing customer grievances in a fast, efficient, and transparent manner. By integrating advanced AI techniques like natural language processing and machine learning, the system can accurately analyze complaint content, automatically categorize issues, and intelligently prioritize cases based on urgency and impact. This ensures that critical complaints are escalated promptly, significantly reducing resolution times and preventing customer dissatisfaction.

The automation of complaint workflows minimizes manual intervention, reducing human error and operational costs while enhancing the overall productivity of support teams.

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