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AI-BASED SMART CUSTOMER SUPPORT AND COMPLAINT RESOLUTION SYSTEM

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Abstract

Customer support is an important part of every organization because customers expect quick, accurate, and convenient solutions to their problems. Traditional customer-support systems often depend on human agents to receive complaints, understand customer issues, search for solutions, and provide responses. As the number of customers increases, support teams may face large volumes of repetitive complaints, resulting in longer response times and increased workload. The AI-Based Smart Customer Support and Complaint Resolution System is proposed as an intelligent platform that uses Artificial Intelligence, Natural Language Processing, and Machine Learning to automate and improvwe customer-support operations.

The proposed system allows customers to submit their questions, complaints, and service requests through a conversational interface. Natural Language Processing is used to understand the customer's message and identify the intent, complaint category, and important information. The system can classify complaints into categories such as payment issues, product problems, delivery delays, account-related problems, technical issues, and service requests. Relevant information can then be retrieved from an organizational knowledge base to generate an appropriate response.

The system can provide automated solutions for frequently occurring and well-defined customer problems. AI-based sentiment analysis can identify whether a customer is satisfied, neutral, frustrated, or highly dissatisfied. Complaint priority can be determined based on factors such as urgency, complaint type, customer sentiment, and business rules. High-priority or complex complaints can automatically be escalated to human support agents with relevant customer information and previous conversation history.

A centralized dashboard can help support teams monitor incoming complaints, resolution status, response times, complaint categories, customer sentiment, and escalation rates. The system can automatically create support tickets, assign categories, update complaint status, and maintain a complete history of customer interactions. Analytics can help organizations identify frequently occurring problems and areas where products or services need improvement.

I. Introduction

Customer satisfaction plays a major role in the success and growth of an organization. Customers may contact support teams for various reasons, including product problems, payment issues, delivery delays, account difficulties, technical errors, and

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service-related complaints. Organizations must respond to these requests efficiently to maintain customer trust and provide a positive service experience. As customer volumes increase, managing all requests manually can become difficult for conventional support teams.

Traditional customer-support systems generally use telephone calls, emails, web forms, live chats, and ticketing systems. These methods provide customers with multiple communication channels, but many processes still depend on human agents. Support employees must read complaints, determine their categories, search for relevant information, communicate with customers, and update ticket records. Repetitive requests can consume significant time and prevent agents from focusing on complex customer problems.

Artificial Intelligence can automate several stages of the customer-support process. Natural Language Processing allows systems to understand customer messages written in natural language. Machine-learning techniques can classify complaints, analyze customer sentiment, identify important entities, and predict complaint priority. Knowledge-retrieval techniques can help the system locate relevant solutions from frequently asked questions, product documentation, policies, and previous support records.

The proposed **AI-Based Smart Customer Support and Complaint Resolution System** integrates these technologies into a unified support platform. Customers can communicate with the system through a chatbot or web-based interface and describe their problems in ordinary language. The AI engine analyzes the message, determines the complaint category, retrieves relevant information, and provides an appropriate response. When an automated solution is not sufficient, the complaint can be transferred to an authorized human support agent.

The primary objective of the system is to improve response speed, reduce repetitive support workload, and provide consistent customer assistance. The system can operate continuously and support customers outside traditional working hours. By combining automation with human escalation, the proposed platform can provide efficient support while ensuring that complex, sensitive, or unresolved complaints receive appropriate human attention.

II. Literature Survey

Traditional customer-support systems have primarily relied on human agents, telephone support, email communication, and ticket-management platforms. Customers submit their complaints and support representatives manually analyze and resolve them. Ticketing systems improve organization by assigning identifiers and tracking complaint status, but the diagnosis and response process often remains dependent on human effort. As complaint volumes increase, support queues can become difficult to manage.

Rule-based chatbots were introduced to automate frequently asked questions and simple customer interactions. These systems use predefined questions, keywords, and

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response rules to provide answers. They can efficiently handle common queries but often struggle when customers use unexpected wording or describe multiple problems in one message. Their limited ability to understand context makes them less effective for complex customer interactions.

Natural Language Processing has improved the ability of automated support systems to understand customer messages. NLP techniques can be used for intent classification, entity extraction, text classification, and sentiment analysis. These capabilities allow support systems to identify the purpose of a customer's message and extract information such as order numbers, product names, dates, or complaint categories. However, the effectiveness of NLP systems depends on the quality and diversity of training data.

Machine-learning approaches have also been applied to customer-support analytics. Classification models can categorize complaints, while sentiment-analysis models can estimate customer satisfaction or frustration. Predictive models can help identify complaints that may require urgent attention. These approaches can improve support prioritization, but they generally need to be integrated with customer-service workflows to produce useful operational outcomes.

Recent Generative AI and Large Language Model applications have expanded automated customer support capabilities. AI systems can generate natural-language responses, summarize conversations, retrieve information from organizational documentation, and answer follow-up questions. Retrieval-Augmented Generation can help ground responses in trusted company information rather than relying solely on the language model's internal knowledge. Appropriate safeguards are necessary to reduce inaccurate responses and protect customer information.

Modern intelligent customer-support systems increasingly combine conversational AI, knowledge retrieval, sentiment analysis, automated ticket management, analytics, and human escalation. These systems aim to provide an end-to-end workflow from complaint submission to resolution. The proposed system follows this approach by integrating AI-based complaint understanding, classification, knowledge retrieval, automated resolution, priority assessment, escalation, ticket management, and customer-support analytics.

III. System Analysis

The proposed system provides an intelligent platform for receiving, understanding, processing, and resolving customer complaints. Customers can submit complaints through a chatbot, web portal, mobile application, email, or other supported communication channels. The Natural Language Processing module analyzes the customer's message and identifies the intent, complaint category, entities, and urgency. A sentiment-analysis component evaluates the emotional tone of the customer's message and identifies potentially dissatisfied customers. The complaint-classification module categorizes issues such as payment, delivery, product, account, technical, or service problems. The system retrieves relevant information from an approved knowledge base containing FAQs, policies, product information, troubleshooting

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guides, and previous resolutions. An AI response engine generates a suitable answer based on the retrieved information and customer context. For supported complaint types, the system can initiate predefined resolution workflows or create appropriate service requests. A priority engine assigns complaint priority based on predefined business rules, urgency, sentiment, and complaint category. If the system cannot confidently resolve the complaint, it automatically escalates the case to a human support agent. All customer interactions, responses, actions, and complaint statuses are recorded in a centralized database. A dashboard provides support teams with complaint statistics, active tickets, resolution rates, response times, and customer sentiment trends. The system therefore provides an end-to-end workflow for intelligent customer assistance and complaint management.

Existing System

Existing customer-support environments commonly depend on call centers, emails, live-chat agents, FAQ pages, and conventional ticketing systems. Customers submit their complaints through different communication channels and wait for support representatives to respond. Human agents manually read the complaint, understand the issue, search for relevant information, and provide a solution. During periods of high demand, large numbers of tickets can accumulate and increase customer waiting times. Basic chatbot systems may handle simple frequently asked questions but generally have limited contextual understanding. Traditional systems may also require agents to manually categorize complaints and assign priorities. Customer sentiment is often determined informally by support representatives rather than through automated analysis. Complex complaints may require several interactions before reaching the appropriate department. Different customer-support channels may also maintain separate records, making centralized analysis difficult. Manual ticket updates and documentation increase the workload of support teams. Existing systems may provide historical reports but often offer limited predictive or intelligent insights. Automated resolution capabilities are usually restricted to simple predefined workflows. These limitations create the need for an AI-powered system capable of understanding complaints, generating appropriate responses, prioritizing cases, and escalating complex issues efficiently.

Disadvantages of Existing System

- Heavy dependence on human support agents.
- Long response times during high-demand periods.
- Large ticket queues can reduce customer satisfaction.
- Repetitive complaints consume agent time.
- Manual complaint categorization can be inconsistent.
- Limited understanding of natural-language complaints.
- Basic chatbots may provide rigid predefined responses.
- Limited automated sentiment analysis.
- Manual complaint prioritization can delay urgent cases.
- Support information may be distributed across different systems.
- Limited automated complaint resolution.
- Manual ticket updating increases administrative workload.

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- Complex complaints may require multiple interactions.
- Limited predictive analysis of recurring customer problems.
- Difficult to provide efficient 24/7 human-level support.

Proposed System

The proposed system introduces an AI-powered platform for smart customer support and automated complaint resolution. Customers can submit questions and complaints through a conversational chatbot, web application, mobile application, or integrated communication channel. The NLP module processes customer messages and identifies intent, entities, complaint category, and urgency. A sentiment-analysis component evaluates customer emotions and helps identify dissatisfied or frustrated customers. The system retrieves relevant information from a trusted knowledge base containing FAQs, policies, product documentation, and previous approved solutions. A Generative AI component uses the retrieved information and customer context to produce clear and relevant responses. For common issues, the system can execute predefined resolution workflows or initiate authorized service actions. A complaint-priority engine ranks cases according to urgency, category, sentiment, and organizational rules. If the AI cannot confidently resolve an issue, the complaint is automatically escalated to an appropriate human support agent. The system transfers conversation history, customer information, classification results, and troubleshooting steps to the human agent to avoid repeated questioning. All complaints and resolution activities are stored in a centralized database. A dashboard provides real-time information about ticket volume, complaint categories, resolution rates, response times, sentiment, and escalations. Historical analytics can identify recurring complaints and potential service-quality problems. This integrated approach enables organizations to provide faster, more consistent, and more intelligent customer support.

Advantages of Proposed System

- Provides automated customer support.
- Offers 24/7 assistance for supported queries.
- Understands natural-language customer complaints.
- Automatically classifies complaints.
- Performs sentiment analysis.
- Automatically prioritizes important complaints.
- Provides AI-generated personalized responses.
- Uses trusted knowledge sources for support answers.
- Automates common complaint-resolution workflows.
- Reduces repetitive workload for human agents.
- Automatically creates and updates support tickets.
- Provides intelligent human escalation.
- Transfers complete conversation context during escalation.
- Provides real-time support analytics.
- Helps identify recurring customer problems.
- Improves response and resolution efficiency.

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IV. Methodology

The methodology of the proposed system consists of multiple stages beginning with customer interaction and ending with automated resolution or human escalation. The first stage is **complaint collection**, where customers submit their questions or complaints through a chatbot, web portal, mobile application, or integrated communication channel. The NLP module preprocesses the text and identifies the customer's intent, important entities, and complaint category. A sentiment-analysis model evaluates the emotional tone and determines whether the customer appears satisfied, neutral, frustrated, or highly dissatisfied. The complaint-classification module categorizes the issue into predefined service areas. The system then retrieves relevant information from an approved knowledge base using semantic search or other suitable retrieval techniques. The AI response engine generates a response based on the retrieved information, customer context, and organizational policies. For eligible issues, the system can execute predefined workflows such as checking request status, providing troubleshooting instructions, or creating a service request. A priority module evaluates urgency, sentiment, complaint type, and business rules to determine the appropriate priority. The system verifies whether the issue has been resolved through customer confirmation or available service-status information. If resolution is unsuccessful or the issue requires human judgment, the complaint is escalated to an authorized support agent. The complete conversation and troubleshooting history are attached to the ticket for efficient human handling. Finally, complaint and performance data are analyzed using metrics such as response time, resolution rate, escalation rate, classification accuracy, customer satisfaction, and first-contact resolution rate.

System Architecture

The system architecture consists of several interconnected components including the Customer Interaction Layer, NLP and Intent Processing Layer, Complaint Classification Module, Sentiment Analysis Module, Knowledge Retrieval Layer, AI Response Engine, Resolution Workflow Engine, Priority and Escalation Module, Ticket Management System, Database, Analytics Engine, and Support Dashboard. The process begins when customers submit complaints through a chatbot, web portal, mobile application, email, or other supported channels. The interaction layer forwards the customer message to the NLP module, which analyzes intent, entities, and context. The complaint-classification component determines the category of the issue, while the sentiment-analysis component evaluates the customer's emotional tone. The knowledge-retrieval layer searches approved FAQs, policies, product documentation, troubleshooting guides, and previous verified resolutions. The AI response engine uses the retrieved information to generate a relevant and understandable response. For supported issues, the resolution workflow engine performs authorized automated actions or provides guided solutions. The priority module evaluates complaint severity and determines whether the case should be handled automatically or escalated. Unresolved, sensitive, or high-priority complaints are transferred to human support agents together with the complete conversation context. The ticket-management component creates, updates, assigns, and tracks support tickets throughout their lifecycle. All relevant interactions and resolution information are

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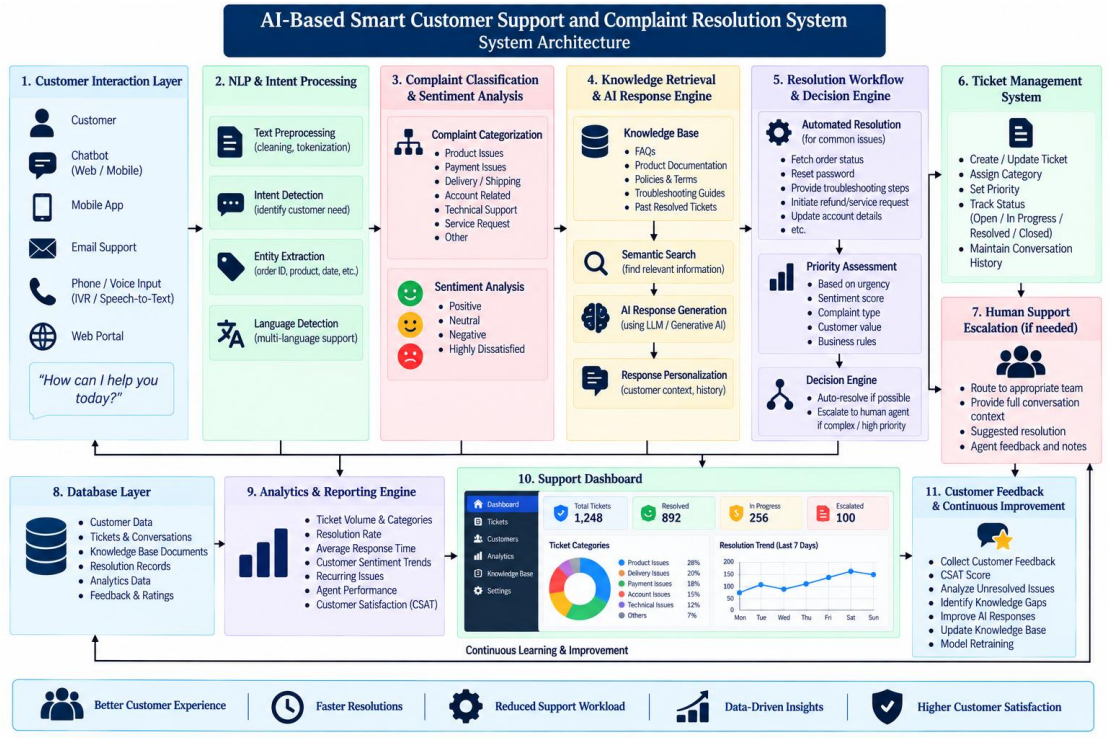
stored in a centralized database. The analytics engine processes historical data to identify complaint trends, response performance, customer sentiment, and recurring service issues. The dashboard presents live complaint status, AI resolution rates, escalations, customer satisfaction, and support analytics to authorized personnel. The complete architecture follows the flow **Customer → Chatbot/Web/Mobile → NLP → Intent & Complaint Classification → Sentiment Analysis → Knowledge Retrieval → AI Response & Resolution → Priority Check → Ticket Management → Database → Analytics Dashboard → Human Support Escalation when required**.



V. Result and Output

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VI. Conclusion

The AI-Based Smart Customer Support and Complaint Resolution System provides an intelligent and automated solution for managing customer queries, complaints, and service requests. By combining Artificial Intelligence, Natural Language Processing, Sentiment Analysis, Knowledge Retrieval, and Generative AI, the system can understand customer concerns and provide relevant responses efficiently.

The proposed system can automatically classify complaints, analyze customer sentiment, determine priority, retrieve appropriate solutions, and resolve common issues without requiring continuous human intervention. Complex or high-priority complaints can be automatically escalated to human support agents along with the customer's complete conversation history and relevant information.

The centralized dashboard provides valuable information such as ticket status, complaint categories, resolution rates, response times, customer satisfaction, and sentiment trends. These analytics help organizations identify recurring customer problems and improve their products, services, and support processes.

Overall, the project demonstrates how AI can transform traditional customer support into a faster, smarter, and more customer-centric system. It can reduce support workload, improve response times, provide 24/7 assistance, and enhance customer satisfaction. Future enhancements can include multilingual support, voice-based customer assistance, predictive complaint detection, advanced Generative AI, automated CRM integration, and intelligent personalized recommendations.

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