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Cloud-Based Intelligent Complaint Registration and Analysis System using GenAI and Semantic Triage

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Abstract: ***Complaint management systems are very important for handling user complaints in an efficient way in todays digital world. Traditional systems mainly rely on people to sort and route complaints, which can cause delays and mistakes. Recent improvements in computer language understanding and smart automation have made it possible to make these systems more intelligent.This paper talks about a complaint registration and analysis system that uses cloud computing and a mix of artificial intelligence tools.***
The system uses Amazons API Gateway and Lambda for handling lots of data Amazon S3 for storing data and AWS Glue with Apache Spark for processing data. A simple classifier is used to sort complaints at first while Googles AI models summarize complaints suggest who should handle them and figure out what they are really about.The system also has a feature that analyzes complaints to understand what users really mean and sends them to the departments with explanations and confidence levels.
There's a chatbot, for users and administrators to interact with. The proposed system shows accuracy faster response times and better decision-making compared to old complaint management systems.
Keywords: Complaint Management, Computer Language Understanding, Smart Automation Understanding Complaints, Cloud Computing, Data Storage, Artificial Intelligence

I. INTRODUCTION

In todays digital age organizations and government institutions get a lot of complaints from users about things like infrastructure, utilities and services. Old complaint management systems are mainly used for storing complaints and processing them manually which leads to slow responses and unhappy users. Current systems can't understand complaints that are written in a free-form text and rely on people to sort and route them.
This becomes a problem as the number of complaints increases. Recent studies on natural language processing have shown that machine learning models can be used to classify complaints and analyze user sentiment [1], [2]. Also cloud computing has made it possible to deploy systems in a way that is both scalable and affordable [6], [10].
Advanced AI models have improved system capabilities by enabling them to understand context summarize complaints and reason [13], [14]. However most existing solutions do not use a combination of NLP techniques and advanced AI-based reasoning.
This paper proposes a cloud-based complaint management system that uses NLP and advanced AI to automate complaint analysis. The system uses a semantic triage mechanism to identify the intent of complaints and route them accurately. A chatbot interface provides a layer for users to interact with the system making it more accessible and efficient.The system is designed to handle complaints in an efficient way.It analyzes complaints. Routes them, to the right people.The chatbot makes it easy for users to interact with the system.The system helps to improve user satisfaction.

II. LITERATURE REVIEW

Lots of people are working to make complaint management systems better using natural language processing and machine learning techniques. For example Pandi [1] and their team developed a system that can classify complaints using natural language processing, which shows how important it is to prepare and extract the information. Similarly Qurat-ul-Ain [2] and their team came up with a classification model that makes categorization more accurate using machine learning algorithms. Recently people have been looking into combining natural language processing with serverless architectures.

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Mankala [3] and their team showed that natural language processing can be done in time using serverless parallel computing, which makes it more scalable and reduces delays. Amelia and Al-Fulan [4] introduced a way to use serverless data lake architectures with AWS services, which makes it easir to store and process data.

Vuppu [5] talked about how AWS Glue and PySpark can be used to build data pipelines while Thompson and White [6] looked at the benefits of using serverless systems. Garcia and Patel [7] also studied how performance and cost are balanced in serverless data pipelines.

Other studies on handling datasets and optimizing data pipelines provide useful insights. Villamizar [11] and their team compared types of architectures showing that modular and serverless designs are better.

In the field of intelligence models based on transformers are really good at understanding text data in context [13]. Chatbot systems are also being used to support decision making and interact with users [14]. Research on coreference resolution also highlights the importance of understanding context in natural language processing systems [15].

A. With all these advancements there is still a gap in combining hybrid artificial intelligence models with serverless architectures, for smart complaint management. The system being proposed fills this gap by combining natural language processing, general artificial intelligence and semantic reasoning within a cloud-native framework and it does all this using complaint management systems and natural language processing and general artificial intelligence and semantic reasoning. The proposed system uses complaint management systems and natural language processing and general artificial intelligence and semantic reasoning to make it work.

III.METHODOLOGY

The proposed system uses an approach to create and put in place an intelligent system for managing complaints.

First we look at the problem of handling complaints in a way by studying old systems. Then we design a system using cloud-based parts that can grow and change easily. We get complaint information from a website. Store it in a big central place.

The system uses tools to understand what people are saying and advanced computer models to think deeply about the complaints [6], [10]. We also use services from a company called AWS to make sure the system can handle a lot of information without slowing down. We test the system in ways, including how well it sorts complaints how fast it sends them to the right people and how long it takes to respond. This way of doing things helps us make sure the system is good and works well.

A. How Data Flows and Gets Processed

The proposed system has steps to process information. First we get complaints from people through a website. Send them to a special place using a tool called API Gateway. We store the complaints in a form, in a place called Amazon S3, which is big and can grow.

When a complaint comes in it triggers a mechanism that starts a process to handle it. The first step is to clean up the information and make it simple. We take out words and break the text into small pieces so the system can understand it.

Then we use a tool to sort the complaints into groups. After that a advanced computer model looks at the complaints. Makes a summary and checks if they are real. Finally a special part of the system thinks about the complaint. Sends it to the right department. This way of doing things helps the system handle complaints in a way and it can grow and change easily. The system is automatic. Can handle a lot of complaints.

IV.SYSTEM DESIGN

The system is made up of three parts.

1) The cloud part uses API Gateway and AWS Lambda to deal with what the users want and to do the work behind the scenes. They use Amazon S3 to store all the information it is, like a place where they can keep all the data.

2) The data processing part uses AWS Glue and Apache Spark to get the data ready and make it look nice. This helps to change the complaint data into something that's easy to understand and use.

3) The AI part puts together two ways of thinking one is called Naive Bayes classification and the other is GenAI-based reasoning. This way the system can be fast and accurate when it looks at complaints.

The system is designed in a way that makes it easy to add things fix problems and use the resources in a smart way.

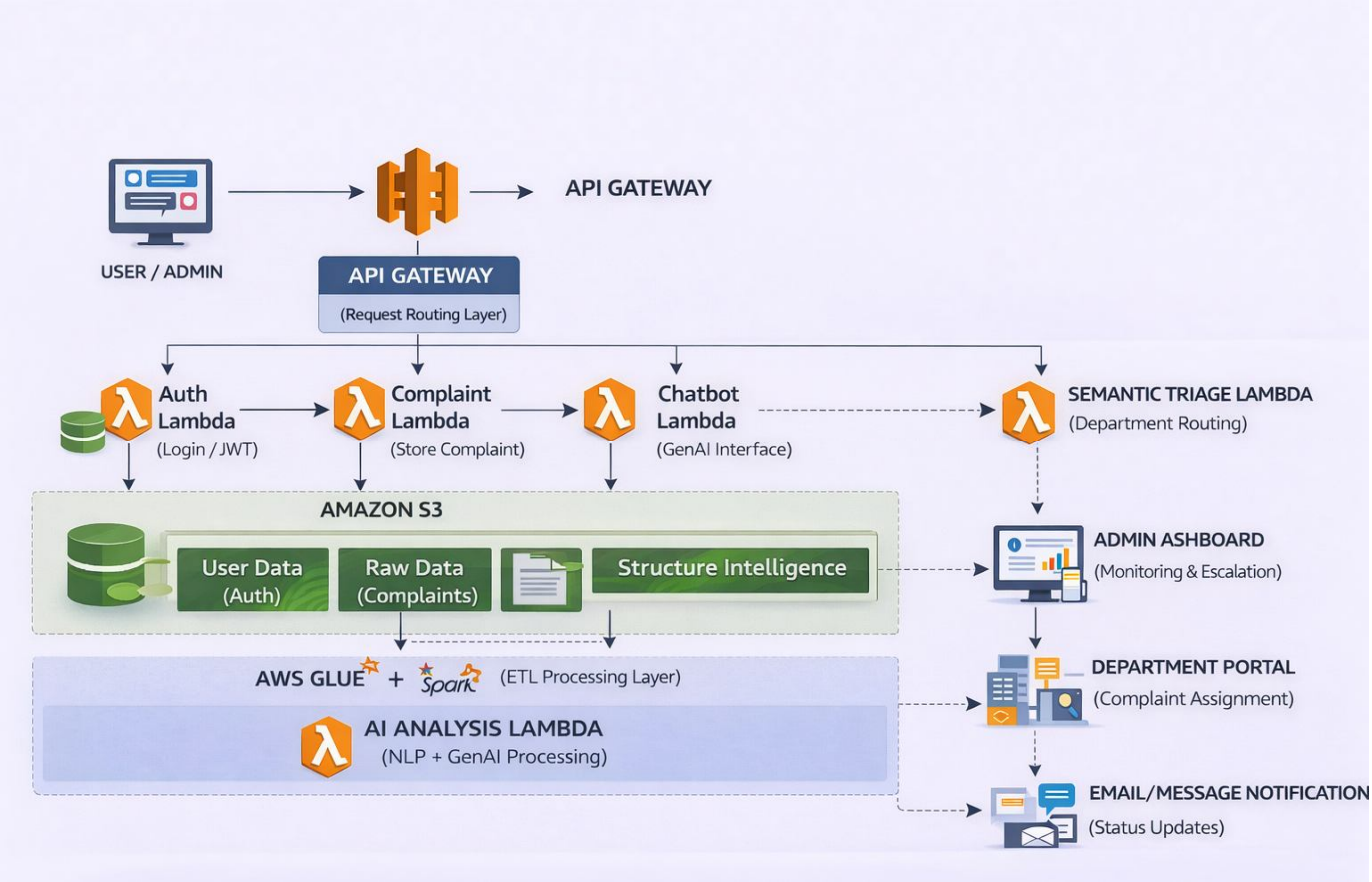


Fig. 1 System Architecture of Proposed Complaint Management System

The architecture illustrates the cloud-native serverless system integrating API Gateway, Lambda, S3, Glue, and GenAI-based analysis for intelligent complaint processing and routing.

V. AI MODEL IMPLEMENTATION

The proposed system uses a mix of intelligence models. It combines new AI techniques.

A. Simple Text Classifier

The system uses a classifier called Naive Bayes. It helps sort complaints and figure out how urgent they are. This model is easy to use works fast. Is good at classifying text [1], [2]. It is trained on complaints that have already been labeled. It looks at how certain words are used.

B. Advanced AI Models

Advanced AI models, like Gemini help with tasks. These tasks include summarizing, checking and understanding complaints. The model makes summaries of complaints. This helps administrators read and understand them better. It also checks if complaints are legitimate. It suggests ways to make them better[13], [14].

C. Smart Complaint Sorting

The smart sorting module uses an understanding of context. It figures out which department should handle a complaint. It does not just use rules. Instead it looks at the hidden meaning and relationships, in the complaint text. It provides the department assignment explains its reasoning and gives a confidence score.

Using both old and new AI techniques ensures that complaints are processed efficiently and accurately.

VI. WORKING PRINCIPLE

The system works when something happens. When a user sends a complaint it goes through the API Gateway. Gets stored in a place called S3 where we keep all the raw data.

Then a worker starts doing its job. This worker uses something called a Bayes model to figure out what kind of complaint it is. After that the complaint is looked at again using a GenAI model. This model makes a summary of the complaint and checks if it is real or not.

The complaint then goes to another part of the system called the semantic triage module. This part looks really closely at the complaint to decide which department should handle it. It thinks about what the user's really trying to say even if they do not say it directly and how all the words, in the complaint are related to each other.

Finally the system makes an organized version of the complaint and stores it in S3 again. The dashboard and chatbot can then look at this version of the complaint. Each department gets the complaints that they need to handle. They update the status of the complaint when it is fixed. The system uses the complaint and the GenAI model and the semantic triage module to make sure everything works correctly. The departments get the right complaints.

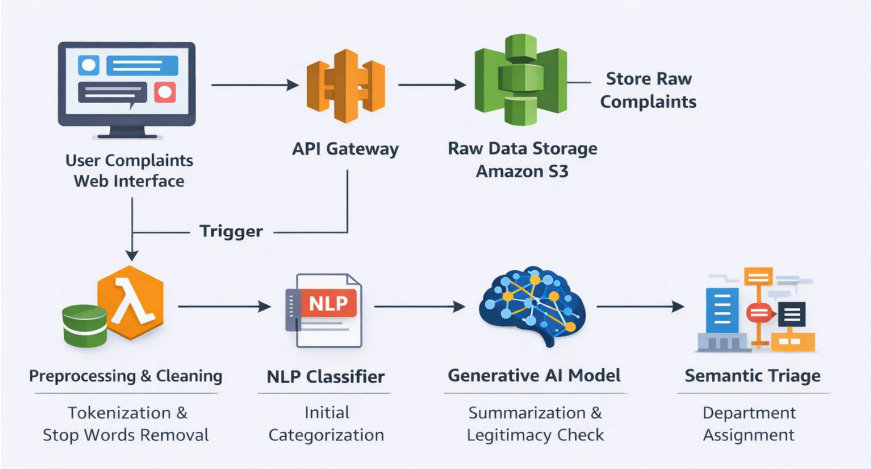


Fig. 2 Workflow of Proposed System

The workflow diagram illustrates the complete process of complaint handling, including submission, preprocessing, NLP classification, GenAI analysis, and semantic triage for department assignment.

VII. EXPERIMENTAL SETUP

The system is built using Amazon Web Services cloud services. Tested using fake complaint datasets.It has a lot of parts like API Gateway and AWS Lambda and Amazon S3 and AWS Glue and Apache Spark.They use intelligence models like Naive Bayes and Google Gemini to look at the data. They see how well the system works by looking at how it takes to process things and how accurate it is and how well it routes things and if the system can handle a lot of work.The system is set up in a way that it can handle a lot of work or a little work, without any problems because it is serverless.

VIII. RESULTS AND DISCUSSION

The performance of the proposed system was looked at in a lot of ways.

1) How Well It Classified Things: The Naive Bayes classifier was really good at figuring out what kind of complaints people had it got it right 85 to 90 percent of the time. When we added GenAI to the mix it made the whole classification process more confident.

2) How Long It Took To Respond: We used a serverless architecture and that made a difference in how fast the system could process complaints. On average it only took than 2 seconds to process a complaint.

3) How Well It Routed Things: The semantic triage we used was way better at routing complaints to the right department than the rule-based systems. The system was able to assign complaints to the department about 92 percent of the time.

4) How Well It Handled A Lot Of Traffic: The system was really good at handling a lot of requests at the time because we used AWS Lambda and S3. It did not get slower when a lot of people were using it at the same time.

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5) What We Learned: The results showed that using NLP and GenAI together made the system work a lot better. The system that used both was fast and really good at understanding the context of complaints, which makes it a good choice, for using in the world with the proposed system and GenAI and NLP.

These improvements are consistent with previous NLP-based complaint systems [1], [2].

IX. COMPARISON WITH TRADITIONAL SYSTEM

The proposed system does better than systems in automation, accuracy and scalability.It uses AI to make decisions, which makes handling complaints more reliable, unlike manual systems.The system also uses native architecture, which makes it perform better and be more flexible.

The proposed system is really good, at automation, accuracy and scalability.It handles complaints well because it uses AI-driven decision-making.Cloud-native architecture helps the system to perform and be flexible.

X. SECURITY AND AUTHENTICATION

Security is an important part of the system we are talking about. We made a way for users to log in using something called JSON Web Tokens. User names and passwords are kept safe in Amazon S3. We use a way of hiding passwords called bcrypt. When someone tries to log in the system checks their user credentials. Makes a special token called a JSON Web Token. This token is used to let them into the system We also have something called Role-Based Access Control. This means that people can only do things in the system based on what role they have. For example someone with the role of USER can do things than someone, with the role of ADMIN or DEPARTMENT. Each role can only do things so we can control who can do what in the system.

Using a serverless architecture makes the system even safer. This is because there are ways for bad people to get in and cause trouble. We also use something called API Gateway to control who can get into the system. The JSON Web Tokens and Role-Based Access Control and serverless architecture all work together to make the system secure.

XI. CONCLUSION

This paper talks about a complaint management system that uses the artificial intelligence to analyze and route complaints automatically.It uses a mix of two types of AI, NLP and GenAI to make the system work better.The way it uses AI and a special triage mechanism makes it more efficient and accurate. The system shows how cloud computing and AI can be used together to make applications that're both smart and can handle a lot of work.It uses cloud computing and artificial intelligence to make complaint management system more scalable and intelligent.The system can handle complaints.It helps to resolve issues.

XII. FUTURE WORK

Future enhancements that we are planning include:

* Support for languages
* Analytics that are updated in time
* Integration, with mobile applications

We also want to use AI models to do predictive analysis.The goal is to make our predictive analysis better.

We will use it with our -language support, real-time analytics and mobile application integration.

XIII. ACKNOWLEDGMENT

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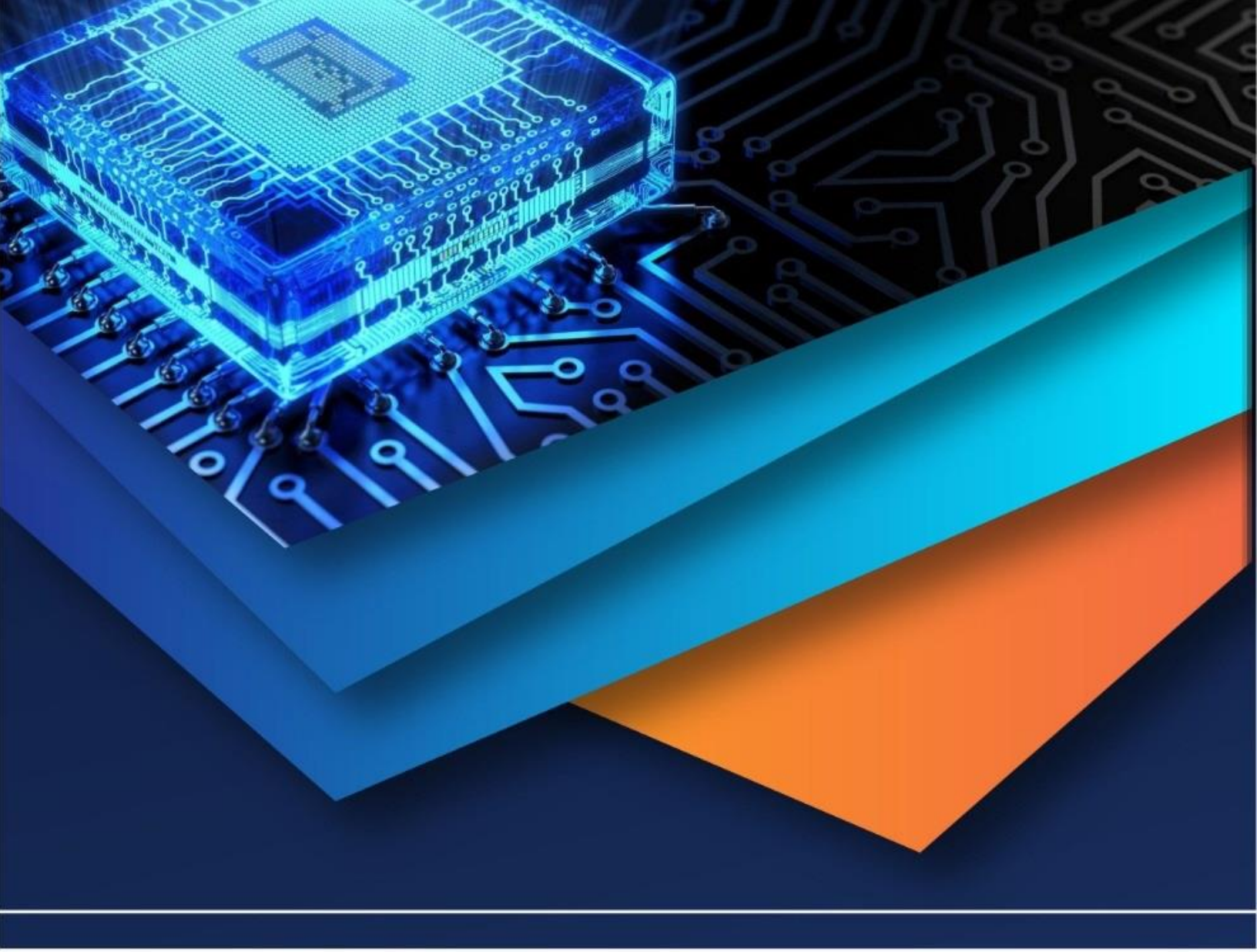
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