Salesforce-Based AI Health Support For Customer Relationship Management(CRM) Using NLP And Predictive Analytics

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Abstract- *Healthcare Smart Support is an Artificial Intelligence (AI)–based healthcare support management system developed using the Salesforce Customer Relationship Management (CRM) platform and a Python-based Natural Language Processing (NLP) engine. Patients submit requests through the Web-to-Case feature in Salesforce CRM, which automatically creates Case records. Non-clinical requests such as Billing, Insurance, Fraud, and Service Issues are converted into Feedback records for sentiment evaluation, while Appointment requests require selection of medical specialization and are routed automatically to the appropriate medical queue.A Scheduled Apex Batch Process (Salesforce server-side automation program) securely sends Feedback text to a Python NLP service hosted on the Python Anywhere cloud platform. The system uses the VADER (Valence Aware Dictionary and sEntiment Reasoner) model to analyze sentiment score, sentiment label (Positive, Negative, Neutral), escalation probability, and healthcare keywords. I developed an AI-based healthcare support system that analyzes patient data to identify risk levels. The results are returned to Salesforce CRM, where predictive insights are generated and alerts are sent automatically to improve patient care and support efficiency.*

Keywords: Artificial Intelligence in Healthcare, Salesforce Customer Relationship Management, Natural Language Processing, Sentiment Analysis, Predictive Insights, Appointment Routing, Case Escalation, Healthcare Automation.

I. INTRODUCTION

In today's rapidly evolving healthcare environment, hospitals, clinics, and medical service providers manage a large number of patient requests every day, including appointment bookings, billing inquiries, insurance verification, technical issues, fraud reports, and service-related complaints. Handling these requests manually through phone calls, emails, or traditional record systems often results in delays, miscommunication, data loss, and inefficient service delivery. As healthcare systems become more digital and patient expectations continue to rise, there is a strong need for an intelligent, automated, and centralized solution that can streamline support processes while improving patient satisfaction. Healthcare Smart Support is developed to address this challenge by integrating **Artificial Intelligence (AI)** with the Salesforce **CustomerRelationship Management (CRM)**platform. CRM is a technology that helps organizations manage interactions, track service cases, and maintain structured records in a centralized environment. In this system, patient requests submitted through the Web-to-Case interface are automatically converted into Case records within Salesforce, ensuring proper documentation, tracking, and prioritization.The system intelligently differentiates between clinical and non-clinical requests. Non-clinical requests such as billing issues, insurance queries, fraud complaints, and service feedback are stored as Feedback records for further analysis, while appointment-related requests require patients to select a medical specialization such as cardiology or orthopedics. Based on this selection, the system automatically generates and routes Appointment records to the appropriate medical department or queue, ensuring efficient scheduling and reduced administrative workload. To further enhance service quality, the system incorporates **Natural Language Processing (NLP)**, a branch of AI that enables computers to understand and analyze human language. Patient feedback text is analyzed using the **VADER (Valence Aware Dictionary and sEntiment Reasoner)** sentiment analysis model enhanced with healthcare-specific vocabulary. The system determines sentiment polarity (positive, negative, or neutral), calculates sentiment scores, identifies important healthcare keywords, and predicts escalation probability to detect potentially critical cases. Based on these predictive insights, Salesforce automation triggers actions such as automated notifications, case reassignment, priority updates, or managerial escalation. By combining automation, intelligent routing, predictive sentiment analysis, and centralized case management, Healthcare Smart Support creates a proactive, efficient, and data-driven healthcare

support ecosystem that improves patient experience and operational performance.

II. LITERATURE REVIEW

In recent years, many researchers have focused on using Artificial Intelligence, Machine Learning, and Natural Language Processing to improve Customer Relationship Management and support systems. These studies mainly concentrate on predictive analytics, sentiment analysis, ticket classification, complaint management, and intelligent routing to enhance automation and decision making. Various algorithms such as Extreme Gradient Boosting, Logistic Regression, Support Vector Machine, Random Forest, and Bidirectional Encoder Representations from Transformers are widely used for customer churn prediction, sentiment classification, and text processing. Deep Learning models such as Convolutional Neural Networks and Recurrent Neural Networks are also applied to improve accuracy in handling complex textual data. Although these systems improve efficiency, response time, and customer satisfaction, they often require large datasets, high computational resources, and complex real-time integration. The following section reviews selected research papers that contribute to the development of intelligent and automated support management systems

[1] This study proposes an Artificial Intelligence (AI)-driven predictive analytics framework to enhance Customer Relationship Management (CRM) systems by improving customer retention, engagement, and satisfaction. The research utilizes Extreme Gradient Boosting (XGBoost) to predict customer churn, enabling organizations to identify customers who are likely to discontinue services. In addition, Bidirectional Encoder Representations from Transformers (BERT) is applied for sentiment analysis to understand customer emotions from textual feedback. The system processes both structured data, such as transaction records, and unstructured data, such as reviews and comments. K-Means clustering is used for customer segmentation to group users based on behavioral patterns. This segmentation supports personalized marketing and targeted service strategies. The framework enhances predictive accuracy and data-driven decision-making. It also enables proactive customer management through intelligent insights. However, the approach requires large datasets and high computational resources for effective performance. The study concludes that integrating AI and Machine Learning significantly strengthens CRM analytics capabilities.

In**[2]**This research focuses on Natural Language Processing (NLP)-based sentiment analysis to convert unstructured customer reviews into meaningful insights. The primary objective is to classify feedback into positive, negative, and neutral categories to measure customer satisfaction levels. The study applies preprocessing techniques such as text cleaning, normalization, and noise removal to improve data quality. The VADER (Valence Aware Dictionary and sEntiment Reasoner) model is used to calculate sentiment polarity and intensity scores. Logistic Regression is implemented as a classification algorithm to categorize the sentiment accurately. The system efficiently handles large volumes of textual feedback. Visualization techniques are used to represent sentiment trends clearly for decision-making. The approach improves service quality by enabling data-driven evaluation of customer opinions. It is scalable and suitable for large datasets. However, limitations include difficulty in detecting sarcasm and challenges in real-time CRM deployment.

In**[3]** This study concentrates on automating customer support ticket categorization using Machine Learning (ML) and Deep Learning techniques to reduce manual workload and improve response efficiency. The system applies text preprocessing methods such as Tokenization, Lemmatization, and Term Frequency–Inverse Document Frequency (TF-IDF) for feature extraction. Various ML algorithms, including Support Vector Machine (SVM), Random Forest, Decision Tree, and Extreme Gradient Boosting (XGBoost), are used for classification tasks. Deep Learning models such as Convolutional Neural Networks (CNN) and Recurrent Neural Networks (RNN) enhance accuracy in handling complex textual data. Topic modeling using Non-Negative Matrix Factorization (NMF) identifies hidden themes in support tickets. The automated approach ensures intelligent routing of tickets to the correct department. It significantly improves response time and prioritization accuracy. The system supports real-time data-driven decision-making. However, model performance heavily depends on the quality and quantity of training data. High computational requirements remain a major limitation**.**

In **[4]**This research emphasizes Artificial Intelligence (AI)-based complaint management systems designed to automate classification, prioritization, and routing processes. The system uses Natural Language Processing (NLP) techniques to analyze complaint text and extract meaningful information. Preprocessing methods such as Tokenization, Lemmatization, and Entity Extraction are applied to improve text understanding. Bidirectional Encoder Representations from Transformers (BERT) is utilized to capture intent and sentiment from customer complaints. Machine Learning models then categorize complaints into appropriate classes. Intelligent routing mechanisms ensure that issues are assigned to the correct department without delay. The automated

system reduces manual intervention and increases operational efficiency. It enhances response time and service quality significantly. Customer satisfaction improves due to faster and more accurate complaint resolution. However, the system requires complex integration, high implementation cost, and large datasets for optimal performance.

In**[5]**This study focuses on sentiment analysis of drug reviews to understand patient feedback and improve treatment recommendations. It uses word-level and sentence-level embeddings with models such as Bi-LSTM, Convolutional Neural Networks, Random Forest, and Deep Neural Networks for analysis. The Random Forest model with advanced embedding techniques achieves the best performance and accurately detects subtle negative feedback. The system also introduces a confidence-based scoring method to reflect both individual opinions and overall user agreement. Additionally, external medical knowledge is used to improve context understanding and recommendation accuracy. However, the approach involves complex models and requires high computational resources. Overall, the study highlights the importance of advanced sentiment analysis for improving healthcare recommendations based on real-world feedback.

In**[6]** This study focuses on improving Customer Relationship Management systems by analyzing unstructured user feedback from digital platforms such as reviews and social media. The proposed framework uses a hybrid Natural Language Processing approach with models like RoBERTa for sentiment analysis, along with text preprocessing techniques such as data cleaning and tagging. It processes feedback through a dual pipeline and provides insights using interactive dashboards. However, the system is domain-specific and requires complex processing. Overall, the study shows the importance of using Natural Language Processing for real-time feedback analysis in Customer Relationship Management systems.

In **[7]**This research focuses on predicting customer repurchase behavior to help companies improve marketing strategies and reduce promotional costs. The study uses Customer Relationship Management data from a home appliance company, including customer profile, purchase history, service interactions, and repair records. A survival analysis-based Machine Learning and Deep Learning approach is proposed to predict the time of product repurchase. Models such as DeepHit and Random Survival Forest are used, showing high prediction performance and identifying key factors influencing repurchase behavior. The system also provides a probability-based prediction over time to help companies decide the best time for promotions. However, the approach is domain-specific and does not focus on sentiment analysis or real-time support systems. Overall, the study highlights the importance of predictive analytics in improving decision making in Customer Relationship Management systems**.**

In **[8]** This research proposes a data augmentation method to handle imbalanced healthcare datasets. The method is inspired by Natural Language Processing techniques that generate synthetic data by replacing words with similar ones. Similarly, it creates synthetic patient records by modifying patient background information using cosine similarity and skip-gram model representations. The approach is evaluated for predicting adverse events caused by drug usage using real-world healthcare data. The results show improved accuracy, precision, and F1-score, especially for rare cases that are difficult to predict. However, the method requires large datasets and higher computational resources. Overall, it improves prediction performance in healthcare systems dealing with imbalanced data**.**

III. PROPOSED SOLUTION

A. Solution : AI-Based Sentiment-Driven Healthcare Support System

This solution proposes Healthcare Smart Support as an Artificial Intelligence (AI)-integrated healthcare support management system developed using the Salesforce Customer Relationship Management (CRM) platform and a Python-based Natural Language Processing (NLP) engine. The main aim of this system is to automate patient request handling, reduce manual effort, improve response time, and detect potential service risks at an early stage. By combining CRM automation with AI-driven sentiment analysis, the system ensures faster and smarter decision-making in healthcare support services.Unlike traditional systems where cases are handled manually, this solution uses predictive sentiment analysis to understand patient emotions and urgency levels from their messages. This allows hospitals to prioritize critical cases quickly and prevent escalation before the issue becomes serious.

1.Automated Case Management Module

In this module, patients submit their service requests through the Salesforce Web-to-Case interface or external portal. The system automatically generates a Case record in the CRM database. Each case is assigned a unique Case ID and categorized into:

- Appointment-related requests
- Billing issues

- Insurance queries
- Technical problems
- Service complaints

If the request is appointment-related, the patient selects the required medical specialization (e.g., cardiology, orthopedics), and the system routes it to the appropriate department. The CRM system also tracks the Service Level Agreement (SLA) to ensure timely resolution. This automation reduces manual data entry and improves case organization.

2.AI-Based Sentiment Analysis Engine

Once a feedback or complaint is recorded, the text data is securely sent to a Python-based NLP engine. The system uses the VADER (Valence Aware Dictionary and sEntiment Reasoner) sentiment analysis algorithm to process the message.

The engine performs:

- Text preprocessing (cleaning and tokenization)
- Sentiment classification (Positive, Negative, Neutral)
- Sentiment score calculation
- Identification of healthcare-related keywords
- Escalation probability prediction

If the sentiment is highly negative or shows urgency, the system marks it as high-risk. This predictive capability allows proactive action before SLA violations occur.

- **3.Intelligent Escalation and Workflow Automation**
- After sentiment analysis, the results are returned to Salesforce CRM. Based on sentiment score and escalation probability, automated workflow rules are triggered.
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- **The system can:**

- Set priority level (High, Medium, Low)
- Send automatic notifications to agents
- Reassign cases to senior staff
- Escalate critical cases to managers
- Trigger alerts for SLA risk

This intelligent automation ensures that critical issues are handled quickly and efficiently without manual monitoring.

IV. SYSTEM ARCHITECTURE

A. System Overview

Healthcare Smart Support is an Artificial Intelligence (AI)-based healthcare support management system developed using the Salesforce Customer Relationship Management (CRM) platform and a Python-based Natural Language Processing (NLP) model. The system allows patients to submit service requests such as appointments, billing issues, insurance queries, and complaints through a web portal. Once submitted, the system automatically creates and manages Case records in Salesforce CRM.The AI module analysis patient messages using sentiment analysis to detect whether the feedback is positive, negative, or neutral. It also predicts escalation probability and Service Level Agreement (SLA) risk. Based on these insights, the system automatically prioritizes, routes, or escalates cases to the appropriate department. Overall, the system reduces manual work, improves response time, enhances patient satisfaction, and ensures efficient healthcare support management.

The system consists of the following four major stages:

Stage 1: Customer Request Submission and Case Creation

The system starts when a patient or customer submits a request through a web portal or online form. This request may be related to appointment booking, billing issues, insurance queries, service complaints, or technical problems. The system collects important details such as patient name, contact information, request category, and message description.

After submission, the Salesforce Customer Relationship Management (CRM) system automatically creates a Case record. Each case is given a unique Case ID for tracking. The system stores all information safely in a centralized database. It also sets a Service Level Agreement (SLA), which defines the time limit within which the issue must be resolved. This stage ensures proper documentation and organized case management.

Stage 2: Text Processing and Sentiment Analysis

After case creation in the Salesforce Customer Relationship Management (CRM) system, the customer message is extracted for intelligent analysis. The textual data is processed using Natural Language Processing (NLP) techniques to identify sentiment, intent, and urgency levels. Advanced predictive analytics models are applied to calculate escalation probability and Service Level Agreement (SLA) breach risk. Preprocessing steps include:

- Text cleaning and removal of special characters
- Tokenization and stop-word removal

- Feature extraction using Term Frequency–Inverse Document Frequency (TF-IDF)
- Sentiment scoring using VADER (Valence Aware Dictionary and sEntiment Reasoner)
- Risk probability calculation using predictive Machine Learning models

These preprocessing and analysis operations ensure that customer messages are accurately interpreted and transformed into structured intelligence, enabling consistent decision-making across various customer interaction scenarios.

Stage 3: Intelligent Decision Making and Routing

In this stage, the system uses the AI results to make smart decisions. Based on sentiment score, urgency level, and escalation probability, the system assigns priority levels such as High, Medium, or Low.If the case is related to an appointment, the patient selects a medical specialization like cardiology or orthopedics. The system automatically routes the request to the correct medical department. If the case is a complaint or billing issue, it is routed to the respective support team. High-risk cases are automatically escalated to senior staff or managers. This reduces manual work and improves response speed.

Stage 4: Agent Assistance and Support Handling

After the ticket is prioritized and routed to the appropriate department, the case is assigned to a support agent for resolution. At this stage, the system provides Artificial Intelligence (AI)-based assistance to improve efficiency and accuracy in handling the case. The AI module analyzes the complete case history, customer message, and sentiment insights to generate a summarized view of the issue. It also suggests recommended actions and possible solutions based on historical case data and knowledge base references. The assistance process includes:

- Automatic issue summarization
- Identification of key problem statements
- Suggestion of next best actions
- Recommendation of similar past resolved cases
- Knowledge base article retrieval
- Context-aware response generation
- Priority confirmation based on risk level

These intelligent assistance operations help support agents understand the issue quickly, reduce response time, maintain consistency in decision-making, and improve overall service quality while minimizing manual effort.

Stage 5: Resolution and Feedback Collection

After solving the issue, the agent updates the case status as resolved or closed. The system records all resolution details for future reference. A confirmation message is sent to the customer. The system may also collect feedback from the patient about the service experience. This feedback can again beanalyzed using sentiment analysis to measure satisfaction level.This stage ensures transparency and continuous improvement.

Stage 6: Analytics and Performance Monitoring

The final stage focuses on reporting and analysis. The system generates dashboards and reports showing important performance indicators such as:

- Average resolution time
- SLA compliance rate
- Escalation percentage
- Sentiment trends
- Agent performance

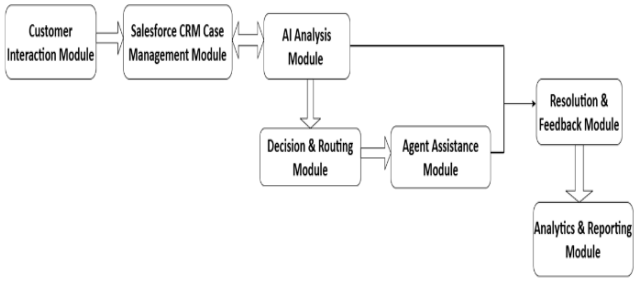

Fig. 1. System Architecture Diagram

Management can use these reports to improve service quality and make better decisions. This stage supports data-driven healthcare support management.

V. FUNCTIONAL ARCHITECTURE

The Functional Flow Activity Diagram explains the complete working process of the Healthcare Smart Support system from request submission to analytics reporting.

The process starts when a customer submits a request through the Web-to-Case feature or an external website. The system first validates the customer details and then creates a Case record in the Salesforce Customer Relationship Management (CRM) system. Based on the request type, the

system checks whether it is related to an appointment or feedback. If it is an appointment, an appointment record is created and updated. If it is feedback or a service issue, a feedback record is generated.After case creation, automation and workflow rules are triggered. The system categorizes the case, sets priority levels, and assigns it to an appropriate support agent. If the case is critical, it is escalated to a senior agent queue. If managerial approval is required, the case is escalated to the manager.

Next, the feedback text is sent to the AI Analysis Module. In this stage, Natural Language Processing (NLP) techniques are applied. The system performs text preprocessing, tokenization, and feature extraction. The processed data is sent to a Python API where sentiment analysis is performed. The system calculates sentiment scores and escalation probability, and then returns the results to Salesforce. The feedback record is updated with these AI insights.After receiving AI results, the Decision & Routing Module activates. The Smart Decision Engine applies AI rules and priority logic. It performs workload checks and provides agent assistance features such as suggested replies, similar case recommendations, and next best actions.The agent then resolves the case and sends the resolution to the customer. After resolution, the system requests customer feedback and stores it for future analysis.Finally, in the Analytics & Reporting Module, the system updates performance metrics, generates dashboards and reports, and produces AI-driven insights.

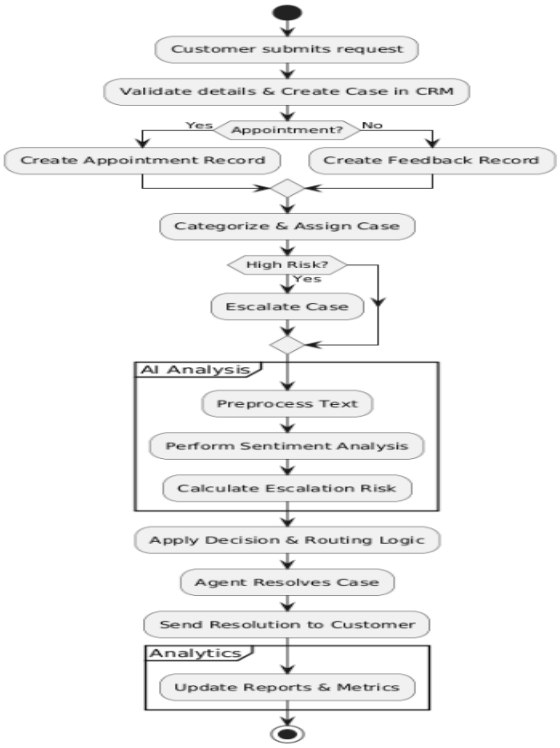

Fig. 2 Functional Architecture Flow Diagram

These insights help management monitor Service Level Agreement (SLA) compliance, escalation trends, sentiment patterns, and overall support performance.

VI. KEYFEATURES

Request Details: Customer name, contact information, request type (Appointment, Complaint, Billing, Technical, Insurance), and message content.

Case Information: Case identification number, case category, priority level, status, and assigned agent details.

Appointment Data: Medical specialization (e.g., Cardiologist, Orthopedic), preferred date, department queue assignment.

Feedback Data: Complaint text, sentiment score, sentiment label (Positive, Negative, Neutral), escalation probability, keywords.

Artificial Intelligence Analysis: Text preprocessing (Tokenization, Cleaning, Feature Extraction) and VADER sentiment analysis.

Decision Logic: Business rules for priority evaluation, escalation handling, and intelligent routing.

Agent Assistance: Suggested replies, similar case solutions, next best action recommendations.

Resolution Data: Case resolution summary, response time, and customer feedback after closure.

Analytics Metrics: Accuracy, Precision, Recall, F1-Score, escalation rate, and performance dashboards.

System Integration: Salesforce Customer Relationship Management automation, Apex batch processing, and secure Python Natural Language Processing service integration.

VII. METHODOLOGY

A.Case Data Collection and Processing

The Healthcare Smart Support system collects patient requests through the Salesforce Web-to-Case interface. Each submitted request includes customer details, request type, and message content. The system validates the input data and automatically generates a Case record in the Salesforce Customer Relationship Management platform.If the request includes feedback or complaint text, the text data is prepared for analysis using text preprocessing techniques such as tokenization, cleaning, stop-word removal, and feature

extraction. This ensures that the textual data is structure and suitable for Natural Language Processing analysis.

B. Artificial Intelligence-Based Sentiment Analysis

After preprocessing, the feedback text is securely sent to a Python-based Natural Language Processing service through a scheduled Apex Batch Process in Salesforce. The system uses the VADER (Valence Aware Dictionary and sEntiment Reasoner) sentiment analysis model, enhanced with healthcare-specific terminology, to analyze the feedback.

$$\text{compound} = \frac{\text{score}}{\sqrt{\text{score}^2 + \alpha}}$$

The model calculates the sentiment score, identifies the sentiment label as positive, negative, or neutral, predicts the escalation probability, and extracts important keywords from the text. Once the analysis is completed, the results are returned to Salesforce and stored in Feedback and Predictive Insight records. This process helps the system identify emotionally sensitive or high-risk cases at an early stage, enabling proactive action and better support management.

C. Decision and Intelligent Routing

Based on the sentiment score and escalation probability generated by the Artificial Intelligence analysis, the Decision and Routing Module evaluates the priority of each case. The system applies predefined business rules to classify cases into critical, high-risk, or normal categories. Critical cases are automatically escalated to managers for immediate attention, high-risk cases are assigned to senior agents for careful handling, and normal cases are routed to regular support agents. For appointment-related requests, the system captures the selected medical specialization and automatically assigns the case to the appropriate department queue. This intelligent routing mechanism ensures accurate scheduling, faster response time, and efficient case management.

D. Agent Assistance and Resolution

The Agent Assistance Module provides real-time insights to support staff, including sentiment results, suggested replies, similar case solutions, and next best action recommendations. This reduces manual effort and improves response efficiency.After reviewing the case, the agent resolves the issue and sends the resolution to the patient. The system then requests feedback and stores it for further analysis.

E. Analytics and Performance Monitoring

The Analytics and Reporting Module collects important data such as case details, sentiment trends, escalation rates, and resolution time metrics to monitor overall system performance. It generates dashboards and detailed reports that help hospital management understand service efficiency and identify areas for improvement. The performance of the Artificial Intelligence model is evaluated using standard metrics such as accuracy, precision, recall, and F1-score. These evaluation measures ensure that the model effectively analyzes patient feedback, correctly classifies sentiment, and

accurately predicts escalation risk, thereby supporting reliable and data-driven decision making.

VIII. RESULT AND EVALUATION

1) Proposed Solution: AI-Based Sentiment-Driven Healthcare Support System

The proposed AI-Based Sentiment-Driven Healthcare Support System **was successfully implemented by integrating** Salesforce CRM with a Python-based NLP sentiment analysis model**. The system was tested using multiple patient feedback records collected from** Web, Email, and Phone channels**. During testing, the system automatically created case records through the** Web-to-Case feature **and categorized them into appointment, billing, technical, and service-related requests.**

Table I. Class-Level Performance Metrics

Class	Precision (%)	Recall (%)	F1-Score (%)	Accuracy (%)
Negative	98.7	96.3	97.4	96.3
Positive	96.5	100.0	98.2	100.0
Neutral	92.3	92.3	92.3	92.3

Table II. Overall Performance Metrics

Metric	Value (%)
Accuracy	97.28
Precision	95.8
Recall	96.2
F1-Score	96.0

The **VADER sentiment analysis model** was used to analyze feedback messages and generate sentiment scores such as **Positive, Negative, and Neutral**. Negative feedback showed higher escalation probability, while positive feedback showed lower risk levels. Neutral feedback had moderate risk values.Based on the sentiment results, the system automatically **prioritized cases and escalated high-risk cases to senior agents or managers**. The analytics module also generated insights such as **sentiment trends, escalation**

rates, and SLA performance. Overall, the system improved **case handling efficiency, reduced manual work, and enhanced patient service quality**.

IX. CONCLUSION

This paper presented a Salesforce-based AI-powered Healthcare Smart Support system that integrates Customer Relationship Management (CRM) with Natural Language Processing (NLP) and predictive analytics to enhance healthcare service management. The proposed system successfully automates patient request handling, case management, and intelligent routing using the Salesforce platform.By incorporating the VADER sentiment analysis model, the system effectively analyzes patient feedback to identify sentiment polarity, urgency, and escalation probability. This enables proactive decision-making, allowing critical cases to be prioritized and escalated at an early stage. The integration of AI-driven insights with CRM workflows significantly reduces manual effort, improves response time, and enhances operational efficiency.Furthermore, the system provides intelligent agent assistance, automated notifications, and performance analytics, contributing to improved service quality and patient satisfaction. The centralized architecture ensures better data management, transparency, and scalability in healthcare support services.However, the system has certain limitations, such as challenges in handling complex linguistic expressions like sarcasm and dependency on predefined sentiment models. Future enhancements may include the integration of advanced deep learning models, real-time processing capabilities, and multilingual support to further improve accuracy and adaptability.Overall, the proposed solution demonstrates that the combination of Salesforce CRM, Artificial Intelligence, and NLP can create a smart, efficient, and proactive healthcare support ecosystem, capable of transforming traditional service management into a data-driven and intelligent system.

X. DISCUSSION

The results obtained from the Healthcare Smart Support system demonstrate that integrating Artificial Intelligence with the Salesforce Customer Relationship Management platform can significantly improve healthcare support management. The system successfully analyzed patient feedback using the Natural Language Processing-based sentiment analysis model and categorized the feedback into Positive, Negative, and Neutral sentiments. The evaluation results indicate that negative feedback generally produced higher escalation probability values, while positive feedback showed lower escalation risk. This confirms that the sentiment analysis model effectively identifies the emotional tone of patient messages and helps detect potential service issues at an early stage. The automated case management and workflow mechanisms also performed effectively during testing. The system automatically created case records, categorized service requests, and assigned them to appropriate support teams. In situations where the escalation probability was high, the system triggered alerts and escalated the case to senior agents or managers to ensure faster resolution. This automation reduces manual monitoring and improves response efficiency within healthcare support operations.

Furthermore, the analytics and reporting module provided valuable insights into feedback trends, sentiment distribution, and escalation patterns. These insights help healthcare organizations understand patient concerns, improve service quality, and ensure compliance with Service Level Agreement (SLA) requirements. Overall, the discussion of results shows that the proposed system provides an efficient, intelligent, and scalable solution for managing healthcare support requests using AI-driven sentiment analysis and CRM automation.

REFERENCES

The following references provide foundational support for the proposed AI-Based Healthcare Smart Support system. These studies focus on Artificial Intelligence, Natural Language Processing, and Customer Relationship Management technologies used for sentiment analysis, ticket classification, and automated support systems. Previous research highlights the use of sentiment analysis models such as VADER and machine learning techniques for analyzing customer feedback and predicting escalation risks. In addition, CRM automation tools such as Salesforce Web-to-Case and workflow management help improve service efficiency. These works support the development of an intelligent healthcare support system that combines AI-based sentiment analysis with CRM automation to improve response time, decision-making, and patient satisfaction.

[1] Janihyam Venkata Naga Ramesh et al.,“AI-Driven Predictive Analytics for CRM to Enhance Retention, Personalization, and Decision Making”*(*International Journal of Advanced Computer Science and Applications (IJACSA) Vol. 16, No. 4, 2025).,

[2] MS.Jyoshnabutty,DR.Jasbir Kaur et al.,“Sentiment Analysis of Customer Reviews Using Natural Language Processing”(International Journal of Scientific Research & Engineering Trends (IJSRET) Volume 10, Issue 5, Sept–Oct 2024*)*.,

[3] c.s.Kanimozhiselviet al.,"Customer Support Ticket Categorization and Prioritization Using NLP,"*IEEE Access,2025*.,
[4] Md.Sohail et al., "AI-Powered Complaint Management and Ticketing System,"IEEE Access,2025.,
[5] Samuel Matia Kangoni et al.,""Enhancing Sentiment-Driven RecommenderSystems With LLM-Based Feature Engineering:A Case Study in Drug Review Analysis""IEEEAccess,VOLUME 13,2025.,
[6] SuvamPoddar et al., "Leveraging Sentiment Analysis of Consumer Feedback for Data-Driven CRM in Digital Game Ecosystems"IEEEAcess,VOLUME 14,2026.,
[7] YoungjungSuh , "Repurchase Prediction Using Survival Ensembles in CRM Systems for Home Appliance Business."IEEEAcess,VOLUME 12,2024.,
[8] Tomoki Ishikawa et al., "An NLP-Inspired Data Augmentation Method for Adverse Event Prediction Using an Imbalanced Healthcare Dataset."IEEE Acess.VOLUME 10,2022.,