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DIABOT - AI Powered Diabetes Chatbot (A Conversational AI System for Personalized Diabetes Risk Prediction and Management)

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Abstract: ***Diabetes mellitus is a critical global health issue requiring continuous education, monitoring and support. In recent years, AI – driven technologies have transformed how healthcare is delivered, offering innovative solutions for disease management. This paper introduces Diabot, an intelligent conversational AI chatbot tailored for diabetes education and risk assessment. By combining Natural Language Processing (NLP), Machine Learning(ML), and Deep learning(DL). Diabot provides dynamic interactions, personalized advice, and early risk prediction. Integrated with message platforms like Telegram, it ensures accessibility and instant support for users, making it a promising tool in AI-powered preventive healthcare.***

Index Terms: AI Chatbot, DiaBot, Natural Language Processing(NLP), Machine Learning(ML), Deep learning, Diabetes Education, Telegram Bot.

I. INTRODUCTION

Diabetes mellitus is one of the most prevalent chronic diseases worldwide, affecting over 422 million people, with numbers steadily rising due to sedentary lifestyle, poor dietary habits, and genetic predispositions. Managing diabetes effectively requires not only medical intervention but also continuous education, lifestyle adjustments, and consistent monitoring. However, the growing burden on healthcare systems and the shortage of medical professionals often hinder timely guidance and personalized support for diabetic patients.

Recent advancement in Artificial Intelligence (AI), particularly in the fields of Natural Language Processing (NLP) and Machine learning (ML), have enabled the development of information systems capable of simulating human-like conversations and delivering healthcare information at scale. Chatbots, in particular, have shown immense potential in addressing routine healthcare, providing emotional support, and offering lifestyle recommendations.

This paper presents Diabot, an AI-powered diabetes chatbot developed to assist individuals in understanding their condition, tracking symptoms, and assessing risk levels. Designed with a user-friendly interface and accessible via platforms like Telegram, diabot interacts in natural language, offering both educational insights and AI-driven predictions based on health data inputs.

The primary objectives of diabot include:

1) Providing 24/7 support and guidance on diabetes-related queries.
2) Using trained ML models to predict risk based on user inputs.
3) Enhancing awareness through personalized recommendations and symptom analysis.
4) Promoting accessible, low-cost healthcare assistance through conversational AI.

With its combination of intelligent NLP, predictive analytics, and platform integration, Diabot serves as a bridge between technology and healthcare, offering a scalable and responsive solutions for diabetes management in both urban and remote areas.

II. LITERATURE REVIEW

The integration of artificial intelligence in the healthcare has seen rapid advancements in recent years, especially in the domains of disease prediction, health education, and patient engagement. Several studies and solutions have focused on chatbot-based systems to provide timely and efficient healthcare guidance.

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A. AI In Healthcare And Chatbot

AI-powered chatbots are being increasingly used to address repetitive tasks, answer health-related queries, and provide mental health support. Tools like Ada Health, Babylon, and Buoy Health have proven the feasibility of conversational agents in healthcare. However, these platforms offer general diagnostic support and lack condition-specific personalization, especially for chronic diseases like diabetes.

According to Wang et al. (2019), the use of machine learning models can enhance diagnostic accuracy in chronic diseases by up to 20% compared to traditional methods. Additionally, Kumar et al. (2020) explored the effectiveness of NLP in healthcare chatbots and that AI-based conversational systems improved patient understanding and satisfaction.

B. Diabetes – Focused Tools

Existing diabetes management tools, such as mySuger, Glucose Buddy, and Blueloop, help users monitor blood glucose levels and medication intake. However, most of these applications are not conversational and often require manual input, which limits engagement.

In a study by Smith and Thomas (2021), it was noted that diabetic patients responded more actively to interactive, conversational-based tolls than static applications. This highlights the potential of chatbot systems in enhancing diabetes self-care.

C. NLP And Prediction Models

Recent advances in NLP, particularly models like BERT, GPT-$, and LLaMa, have enabled machines to better understand and respect to human queries in a meaningful way. These models from the backbone of many intelligent assistants today.

For prediction, traditional models like Logistic regression, K-Nearest neighbors (KNN), and Support Vector Machines (SVM) have been used widely for diagnosing diabetes. However, newer algorithms such as Random Forest, XGBoost, and Deep Neural Networks show improved accuracy and robustness when trained on datasets like the Pima Indian Diabetes Dataset.

D. Gap In Current Systems

I While prior works focus either on conversational AI or predictive models, vey few combine both in a unified system dedicated to diabetes care. Additionally, most existing solutions lack:

1) Real-time messaging platform integration (e.g., Telegram)
2) Personalized educational support using AI.
3) Modular, scalable design for broader use.

Diabotaddress these gaps by combining a smart conversational interface with machine learning – powered diabetes prediction - offering a comprehensive and interactive health assistant.

III. METHODOLOGY

The development of Diabot, an AI-powered diabetes chatbot, follows a modular and structured approach integrating data science, natural language processing, and chatbot development techniques. The entire methodology is divided into key stages: data collection and preprocessing, model building for prediction, natural language preprocessing for chatbot interactions, and system deployment.

A. Data Collection And Preprocessing

For risk prediction, the system uses Pima Indian Diabetes dataset, a widely accepted benchmark in diabetes research. The dataset contains essential health attributes such as:

1) Number of pregnancies
2) Glucose level
3) Blood pressure
4) Insulin level
5) Skin thickness
6) Body Mass Index
7) Diabetes pedigree function
8) Age

Processing Involved:

- Handling missing or zero values using imputations methods

- Feature scaling using standardization
- Splitting data into training and testing sets (80:20 ratio)

B. Machine Learning Model Development

Multiple supervised learning algorithms were evaluated:

- Logistic Regression
- Support Vector Machine (SVM)
- Random Forest
- Neural Netwroks

Among them, Random Forest and XGBoost showed the highest accuracy and were selected for integration into Diabot. Model performance was evaluated using:

- Accuracy
- Precision
- Recall
- F1 Score

C. *Natural Language Processing (NLP) for Interaction*

The conversational capability of diabot is powered by advanced NLP techniques using models like GPT-4 and BERT. These models are used to :

- Understand user intent and context
- Generate human-like responses
- Deliver personalized recommendations

Intent recognition and dialogue management were built using pre-trained models fine-tuned on healthcare-relates conversations

D. System Architecture And Integration

The chatbot architecture consists of the following components:

- Frontend : Telegram messaging interface
- Backend : Python Flask server
- ML Module : Trained prediction model (XGBoost / Random Forest)
- NLP Engine : GPT-4/BERT for dialogue Generation
- Database : For storing user interaction logs and feedback

Diabot was deployed on Telegram to ensure easy access, especially for mobile users. The system uses webhook integration to link Telegram with the backend server.

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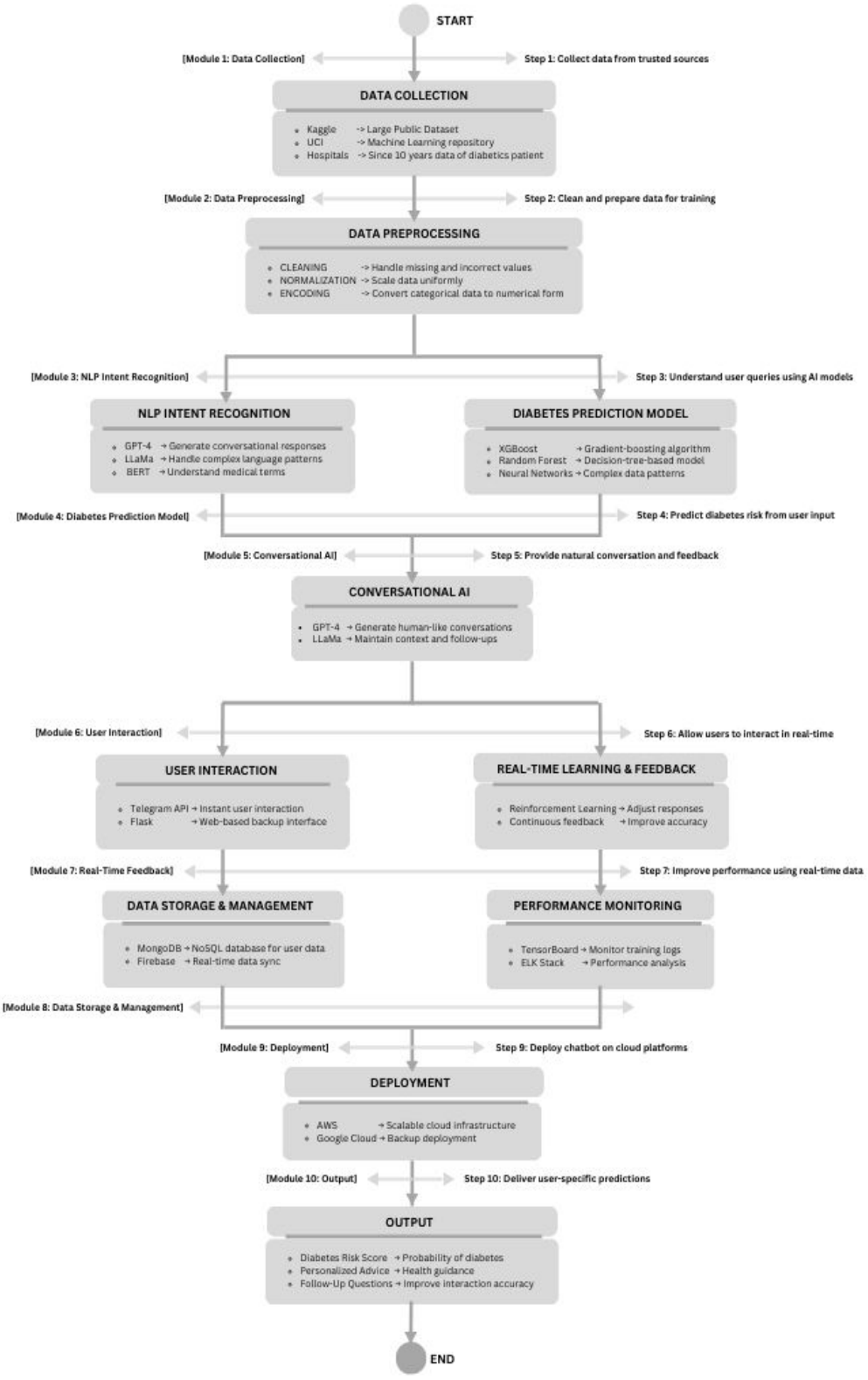


Fig.1 System Architecture

IV. RESULTS AND DISCUSSION

The implementation of Diabot involved the development of both a machine learning-based diabetes risk predictor and an AL-powered conversational interface. The system was tested for performance, accuracy, user experience, and responsiveness.

A. Machine Learning Model Evaluation

Statics To identify the most effective model for predicting diabetes, several algorithms were trained and tested. The models were evaluated on the Pima Indian Diabetes using performance metrices such as accuracy, precision, recall, and F1-score.

Model	Accuracy	Precision	Recall	F1 Score
Logistic Regression	76.3%	0.74	0.70	0.72
SVM	78.1%	0.76	0.72	0.74
Random Forest	82.5%	0.81	0.80	0.80
XGBoost	85.2%	0.84	0.83	0.83
Neural Networks	80.7%	0.79	0.77	0.78

Table.1 Descriptive Statics

XGBoost achieved the highest performance and was integrated into the chatbot for real-time prediction. Its ability to handle feature importance and non-linearity in data contributes to its superior accuracy.

B. Chatbot Interaction And User Testing

The conversational interfaces was deployed on Telegram, where users could interact with Diabot in natural language. The chatbot was tested with a set of 30 users (students and mentors) who provided feedback on the following aspects:

- Ease of Use
- Accuracy of Reponses
- Clarity of Health Advice
- User Engagement

Overall, Diabot achieved a satisfaction rating of 4.5/5 based on user feedback. The chatbot effectively responded to queries about:

- Diabetes symptoms and prevention
- Health tips and diet advice
- Risk-level prediction based on user inputs

C. Discussion

The results demonstrate that combining a conversational interface within Al prediction engine improves both user engagement and health awareness. The chatbot's instant response mechanism, personalized health advice, and friendly language increased user trust and interaction frequency.

Additionally, the integration with telegram allowed users to access Diabot without installing any new application, making it practical and lightweight. The use of GPT-based NLP models ensured smooth, intelligent, and context-aware dialogue flow.

However, some limitations were observed:

- The chatbot cannot provide clinical diagnosis (only risk prediction).
- Performance may depend on internet connectivity.
- Handling complex medical queries still needs refinement.

Future iterations will include multilingual support, integration with devices, and expanding the medical knowledge base.

V. CONCLUSION

This paper presented Diabot, an AI-Powered chatbot designed to support diabetes education, awareness, and early risk prediction. By Integrating machine learning algorithms with natural language processing and deploying the solution on a user-friendly platform like Telegram, Diabot offers a practical, scalable, and accessible digital health companion.

The chatbot successfully provides:

- Real Time, personalized responses to diabetes-related queries
- Accurate risk assessment using trained ML models like XGboost
- Seamless, natural interactions powered by advanced NLP techniques

Experimental results demonstrate that Diabot is not only accurate in prediction but also well-received by users in terms of usability and effectiveness. It brings the gap between AL and healthcare, offering meaningful support to individuals who may lack direct access to medical professionals.

In the future, Diabot can be enhanced by:

- Supporting multiple languages
- Connecting with wearable health devices (e.g., glucose monitors)
- Offering integration with cloud-based electronic health records (EHRs)
- Improving medical query handling using larger LLMs and custom-trained datasets

Diabot serves a promising initiative in the field of AI-driven preventive healthcare, empowering users with knowledge, guidance and motivation for healthier living.

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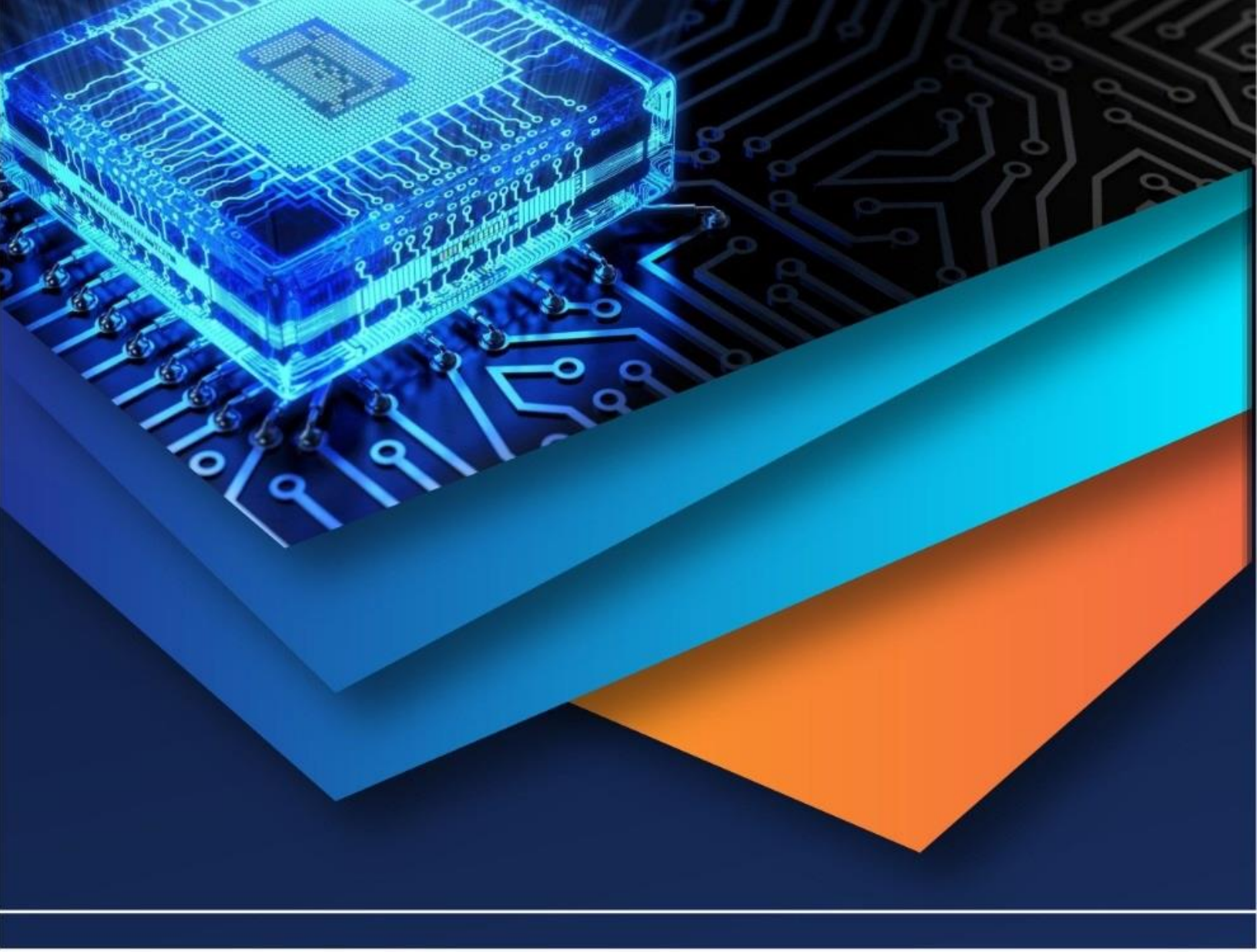
Lastly, we thank all the participants who interacted with Diabot during the testing phase and provided valuable insights its performance and usability.

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