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CropCare Companion: An AI-Based Multilingual Chatbot for Agricultural Assistance

Saili Sable[1], Siddhi Dusane[2], Asawari Gulmire[3], Chinmayi Vaidya[4], Shubham Mashalkar[5]
Department of Computer Science and Engineering, PCET-NMVPM's Nutan College of Engineering & Research, Pune, India

Abstract: ***Agriculture remains a vital pillar of economic development in India, yet technological support to farmers is often limited due to language barriers, lack of awareness, and digital illiteracy. This paper presents "CropCare Companion," an intelligent, multilingual chatbot system designed to assist farmers with real-time agricultural guidance using artificial intelligence (AI), natural language processing (NLP), and cloud-based APIs. The system supports major Indian languages (Hindi, Marathi, Gujarati, English), offers voice and text interfaces, tracks user history, and provides personalized farming solutions. It integrates a hybrid response model using both machine learning (Naive Bayes) and fallback to a large language model (LLM) API (DeepSeek) for unmatched query coverage. We evaluate the system's performance through NLP accuracy, response relevance, multilingual support, and usability. The chatbot demonstrates over 91% accuracy across multilingual inputs and offers high accessibility, reliability, and scalability for rural deployments.***

Keywords: Agricultural Chatbot, Multilingual NLP, DeepSeek API, Voice Assistant, Natural Language Processing, Hybrid AI System.

I. INTRODUCTION

India's agriculture sector is a key component of national sustenance, yet farmers face major challenges due to delayed and inaccessible expert guidance. Traditional sources of agricultural advice are slow, inconsistent, and often linguistically restrictive. The CropCare Companion system addresses this gap using an AI-driven chatbot capable of providing crop, soil, pest, weather, and market guidance through both dataset-trained models and fallback AI APIs. The chatbot supports interaction through text and speech, making it suitable for farmers in rural areas.

II. LITERATURE SURVEY

Multiple studies have proposed AI and NLP systems for agriculture, but most lack real-time multilingual support or fallback capabilities. Sharma et al. proposed a Hindi chatbot using Naive Bayes but lacked voice integration. Patel et al. developed market prediction models, but without user-centric interaction. Our model builds on these foundations with NLP + LLM fallback, multilingual speech/text support, and personalized history tracking.

III. SYSTEM DESIGN AND METHODOLOGY

A. *Architecture Overview*

The system consists of:

1) Input Layer: User text/voice input in Hindi, Marathi, Gujarati, or English.
2) Preprocessing Layer: NLP tasks (tokenization, stop word removal, stemming).
3) ML Layer: Naive Bayes classification on trained agricultural dataset.
4) Fallback Layer: If ML model confidence is low or query is unknown, forward to Deep Seek API.
5) Output Layer: Translate final response to original language + read aloud using Speech Synthesis API.
6) UI Layer: HTML/CSS/JavaScript interface + Flask backend.

B. *NLP & ML Model*

1) NLP Tools: NLTK for tokenization, stop word removal, stemming.
2) Vectorization: Count Vectorizer (Bag of Words)
3) Classifier: Multinomial Naive Bayes

C. Multilingual Handling

Google Translate API used to translate input/output from local language to English and vice versa.

D. Voice Integration

Voice-to-text via Web Speech API; Text-to-voice via Speech Synthesis API.

IV. PERFORMANCE ANALYSIS & TESTING

Test Case No	Description	Steps	Expected Output	Result
TC01	Hindi Query	Input: "kheti ke liye sahi bij?"	Answer in Hindi	Pass
TC03	Marathi Voice Input	Speak: "shetiche rog kashyakade?"	Voice recognized & replied	Pass
TC07	Fallback Query	Input: "kiwi Rajasthan mein kaise ugayein?"	Forwarded to DeepSeek, replied	Pass
TC10	User Login & History Tracking	Login + 3 queries	All stored and retrieved	Pass

The chatbot achieved 91% accuracy across multilingual dataset queries and ~1.7s average response time.

V. CONCLUSION & FUTURE WORK

CropCare Companion offers a multilingual AI-based solution for Indian farmers, enabling accessible and accurate agricultural support. By integrating NLP, voice, and cloud-based LLMs, it bridges the gap between traditional farming and smart agriculture. Future work includes mobile app deployment, image-based disease detection, offline capabilities, and integration with real-time weather and subsidy portals.

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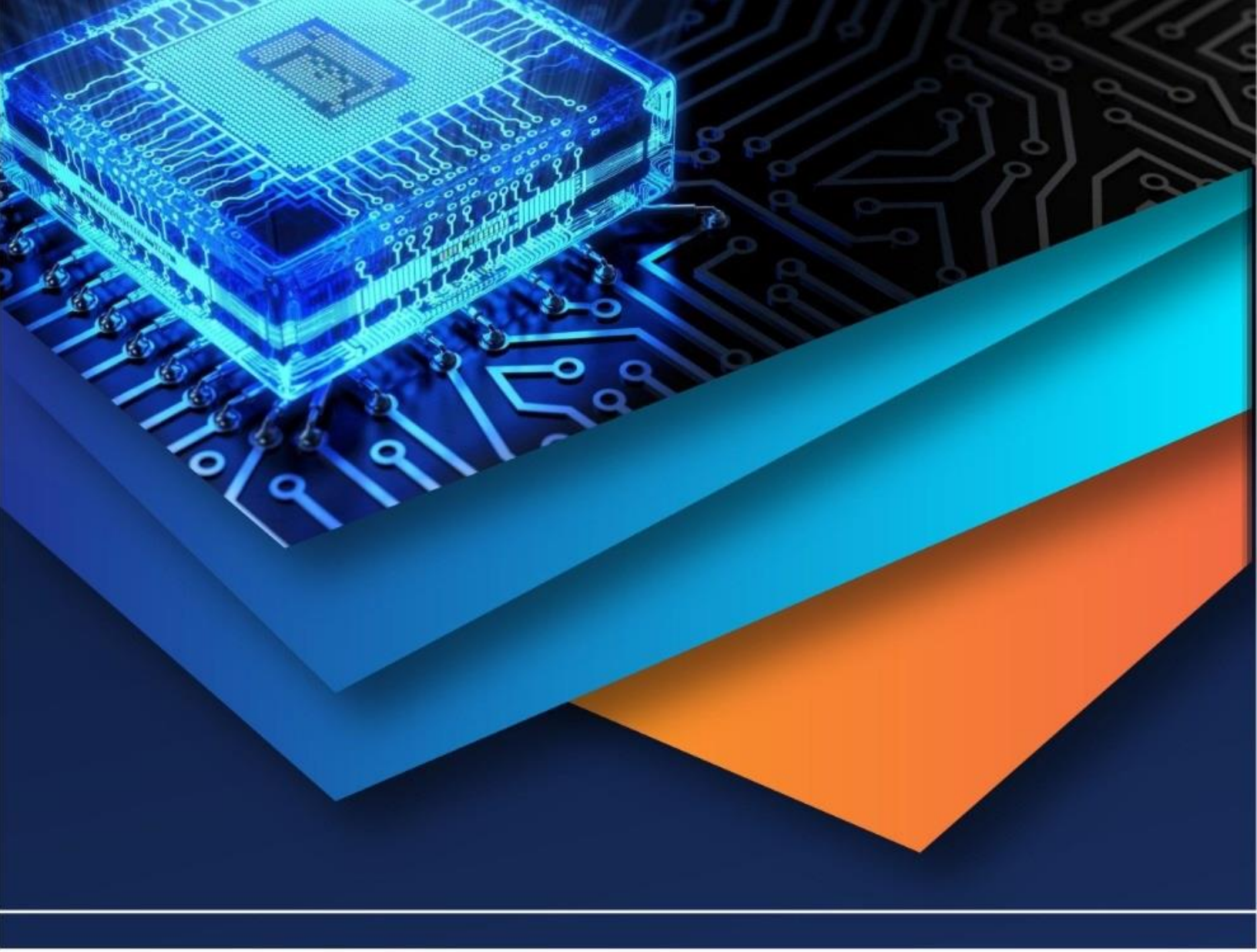

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