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AGRIVOICE-MULTILINGUAL VOICE & TEXT FARMING ASSISTANT

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***Abstract**: AgriVoice is an intelligent, multilingual assistant aimed at empowering Indian farmers by offering agricultural guidance via both voice and text communication. It addresses common challenges in rural agriculture such as language barriers [4], low digital literacy [11], and lack of access to timely data [11]. The system uses OpenAI's GPT model [1] for natural language understanding and integrates Google Cloud's Text-to-Speech (TTS) [3] and Speech-to-Text (STT) [2] for voice interaction. Google Translate API [4] enables communication in major Indian languages, making the chatbot highly inclusive and user-friendly. The platform offers essential services including crop recommendations based on soil, season, and region [10]; weather forecasts using the OpenWeather API [5]; market insights with live crop prices and trends sourced from Agmarknet [6]; the system also offers tailored information on government loans and subsidies [13], customized according to individual user profiles. Users can register securely with OTP-based email authentication and manage their profiles with details like location, farming type, and language preferences. All chat data is stored in MongoDB [7]. Developed using Flask [8] for the backend and HTML/CSS/JavaScript [9] for the frontend, AgriVoice ensures a responsive and accessible interface. By combining AI [1], multilingual support [4], and voice technology [2][3], AgriVoice empowers farmers with accurate, localized information to make better farming decisions and improve productivity.*

***Keywords:** Agriculture, GPT, Voice Interface, Multilingual Chatbot, Crop Recommendation, Weather Forecasting, Market Price Trends, TTS, STT*

Introduction:

Agriculture significantly contributes to the economic foundation of many developing countries, especially India, where it remains the primary occupation for a large portion of the population [11]. Despite its importance, the agricultural sector faces numerous challenges that hinder its growth and productivity. Among the most prominent are the lack of real-time, localized information [10], language and literacy barriers [13], limited access to expert guidance, and a general disconnect from modern technological advancements [12]. These challenges are particularly severe in rural areas, where farmers often struggle to make informed decisions regarding crop selection, pest management, and market trends [14]. To address these issues, we present AgriVoice – Multilingual Voice & Text Farming Assistant, an AI-powered solution that aims to transform the way farmers access agricultural information [10]. AgriVoice is designed to provide real-time farming assistance using both voice and text interactions [1], enabling communication in multiple regional languages [4]. This inclusivity ensures that even farmers with low literacy levels or limited technical knowledge can benefit from the platform [13]. The system integrates advanced technologies like

Artificial Intelligence [1], Speech-to-Text (STT) [2], Text-to-Speech (TTS) [3], and AI-powered chatbots to deliver customized agricultural guidance. AgriVoice supports popular messaging platforms such as WebApp [8]. The system offers a range of features including AI-driven crop recommendations [10], weather forecasts via the OpenWeather API [5], market price alerts, and financial advisories [6]. MongoDB is employed for real-time data management [7], while OpenAI GPT serves as the chatbot engine [1]. This project addresses key problems such as language inclusivity [4], digital illiteracy [13], and fragmented agricultural support systems [11]. By integrating multiple services into a single, user-friendly interface, AgriVoice creates an ecosystem that is accessible, scalable, and impactful [10].

Literature Survey:

Title: ***"AgriBot: A Conversational Agent for Indian Farmers Using NLP" Authors: R. Mehta, A. Sharma [11]***

Abstract: Agriculture remains a primary livelihood for a large portion of India's population, but access to expert advice and government schemes is limited in rural areas. The authors present AgriBot, a chatbot powered by Natural Language Processing (NLP) techniques [11] designed to assist farmers with crop recommendations, weather updates, and market prices. The system supports both Hindi and English, enabling broader reach among semi-literate users [11]. The chatbot leverages rule-based matching and intent classification to understand queries and fetch relevant information [11]. Evaluations indicate high user satisfaction in pilot deployments. However, scalability and voice support were cited as areas for future improvement.

Title: ***"AI-Based Farming Assistant with Real-Time Weather and Market Insights" Authors: A. Patil, S. Iyer[10]***

Abstract: This paper introduces a smart AI-powered farming assistant tailored for Indian agricultural communities, particularly those with limited access to digital infrastructure and language support [10]. The assistant is built on a Flask backend architecture [8], using MongoDB as the primary database for managing user profiles, chat histories, farming preferences, and session data [7]. It incorporates OpenAI's GPT language model [1] to process and understand user queries related to crops, weather, government schemes, market prices, and subsidies. To ensure usability across India's linguistically diverse population, the system integrates the Google Translate API [4] for auto-detection and translation of input queries, and Google Cloud Text-to-Speech (TTS) and Speech-to-Text (STT) APIs [2][3] to support voice-based interaction. Real-time weather forecasts are retrieved using the OpenWeatherMap API [5], while market price trends are sourced from Agmarknet [6], providing farmers with actionable insights for decision-making. The assistant also features a rule-based and data-driven crop recommendation engine [10] that suggests suitable crops based on season, soil type, and geographical region. It offers responses in the user's selected language, improving accessibility and ease of use [10]. Evaluation of the system was conducted across multiple states with varying soil profiles and climatic conditions. Results showed high reliability in NLP performance and real-time response generation [10]. However, certain limitations were noted, such as reduced accuracy of STT in noisy rural environments [3] and the need for better support of regional dialects and colloquial terms [13]. The paper concludes that with additional fine-tuning and broader dataset integration, the assistant could serve as a scalable solution for smart agriculture and rural empowerment.

More references were:

Classification of Agricultural Queries Using NLP and Transformer Models: A. Srinivas; K. Ramesh; M. Naik; P. Venkatesh IEEE 2019[12]

Automatic Response System for Farmers Using Multilingual Chatbot with Weather and Market Data Integration: Jingyi Lin; Zijian Guo; Dong Li; Xiaorui Hu; Yun Zhang IEEE 2019[13]

Enhancing Agricultural Assistance Using GPT-Based Conversational AI and YOLOv8 Crop Image Detection: Rahul Talukdar; Soumyadeepa Dutta; Soma Das IEEE 2023[14]

Proposed System:

To overcome the limitations present in current agricultural advisory platforms, the proposed system- AgriVoice: A Multilingual Voice & Text Farming Assistant—introduces an innovative, AI-driven conversational assistant aimed at empowering farmers through real-time, accessible, and regionally adaptable support. This system leverages advanced technologies such as Artificial Intelligence, Speech-to-Text (STT) [2], Text-to-Speech (TTS) [3], and AI chatbots built using frameworks like OpenAI GPT [1] to deliver an intuitive and personalized experience. AgriVoice is designed to provide agricultural assistance through both voice and text input modes, catering especially to farmers who face challenges due to illiteracy, language barriers, or digital inexperience. The solution ensures compatibility across a web app [8], thereby allowing farmers to interact with the assistant using tools they are already familiar with, eliminating the need for complex apps or interfaces. AgriVoice supports a wide variety of Indian regional languages and dialects, allowing farmers to pose queries either by speaking or typing in their native tongue. These queries are then processed using AI and STT technologies [2], and the responses are returned in both text and synthesized speech format [3], ensuring seamless access to information regardless of the user's literacy level. The core of AgriVoice lies in its intelligent chatbot [1] which interprets user intent, understands context, and responds accurately to questions related to crop selection, sowing practices, pest and disease identification, fertilizer recommendations, irrigation techniques, market price trends, government schemes, and real-time weather forecasts. By using external APIs such as OpenWeatherMap for weather updates [5] and agriculture market databases like Agmarknet for pricing [6], the system provides up-to-date, context-aware, and location-specific recommendations tailored to the user's needs. Furthermore, AgriVoice maintains session continuity and user data (where permitted) to offer increasingly personalized responses over time [7], effectively evolving into a smart, learning-based advisory tool. It breaks the reliance on static, one-way communication by enabling dynamic interaction and real-time decision support.

The architecture includes modules for:

- User interface interaction (via chat platforms and web/mobile frontend) [9],
- Conversion of voice to text and vice versa using advanced speech recognition (STT) and speech synthesis (TTS) tools [2][3],
- NLP engine to analyze and interpret multilingual queries [1],
- AI decision-making logic for farming recommendations [10],
- Backend database (e.g., MongoDB) to store agricultural data, user information, crop facts, and responses [7].

This modular, scalable design ensures that the system can handle a wide range of user queries simultaneously, while maintaining performance and accuracy.

AgriVoice brings several advantages:

- It enables farmers to receive expert agricultural guidance through intuitive, voice-enabled conversations in their native languages [4].
- It integrates critical services like weather [5], market, and financial updates [6].
- It ensures multi-platform availability to reach users even in low-connectivity environments [13].

In practice, a farmer from Tamil Nadu could simply send a voice message in Tamil on WebApp [8] describing yellowing leaves in their paddy field. AgriVoice would convert this speech to text [2], understand the concern using NLP [1], identify potential nutrient deficiencies or diseases, and respond with treatment suggestions in Tamil through both voice and text [3][4]. This level of intuitive, intelligent interaction enables faster decision-making, reduces crop losses, and improves productivity.

Applications of Proposed System:

- Useful in delivering multilingual agricultural advisory services to farmers across rural regions [13].
- 24×7 intelligent chatbot support for crop recommendations, weather updates, and market price guidance [10].
- Enables low-literacy users to interact using voice in their native language [3].
- Assists in identifying eligible schemes, subsidies, and government programs based on user profile [6].
- Can be deployed via mobile, web, or integrated with platforms like WhatsApp for wider reach [13].

Implementation:

- ***Query Acquisition***

The process starts when the user provides an input query through either speech or text interface. For voice-based interaction, the system uses Google Cloud Speech-to-Text (STT) [2] to convert audio input into text. This raw text, possibly in any Indian regional language, is captured by the Flask application [8] and passed to the preprocessing pipeline.

- ***Language Detection and Translation***

The system automatically identifies the user's query language with the help of the Google Translate API [4]. If the query is not in English, it is translated into English so that it can be understood by OpenAI's GPT model [1].

- ***Feature Extraction (NLP Encoding)***

Following translation, the input is processed using GPT's transformer-based natural language framework for contextual embedding [1]. The GPT model analyzes key features of the query-such as intent (weather, crop, market), location context, and user profile details-to generate an appropriate response. These extracted features guide the system in classifying the query and choosing relevant APIs or databases to retrieve factual data.

- ***Classification and Response Generation***

The classified query is passed through appropriate logic modules—crop recommendation engine [10], weather fetcher (OpenWeatherMap API) [5], or market price retriever (Agmarknet API) [6]. Based on the module output and GPT's natural language generation [1], a final response is constructed. The response is stored in English and also translated back into the user's original language using the Google Translate API [4].

- ***Voice Output and Data Logging***

If the user prefers voice output, the response is converted to speech using the Google Text-to-Speech (TTS) API [3] and played back. All data—original query, translated text, detected intent, model output, response text, and timestamps—are securely logged in MongoDB [7] along with the user's profile

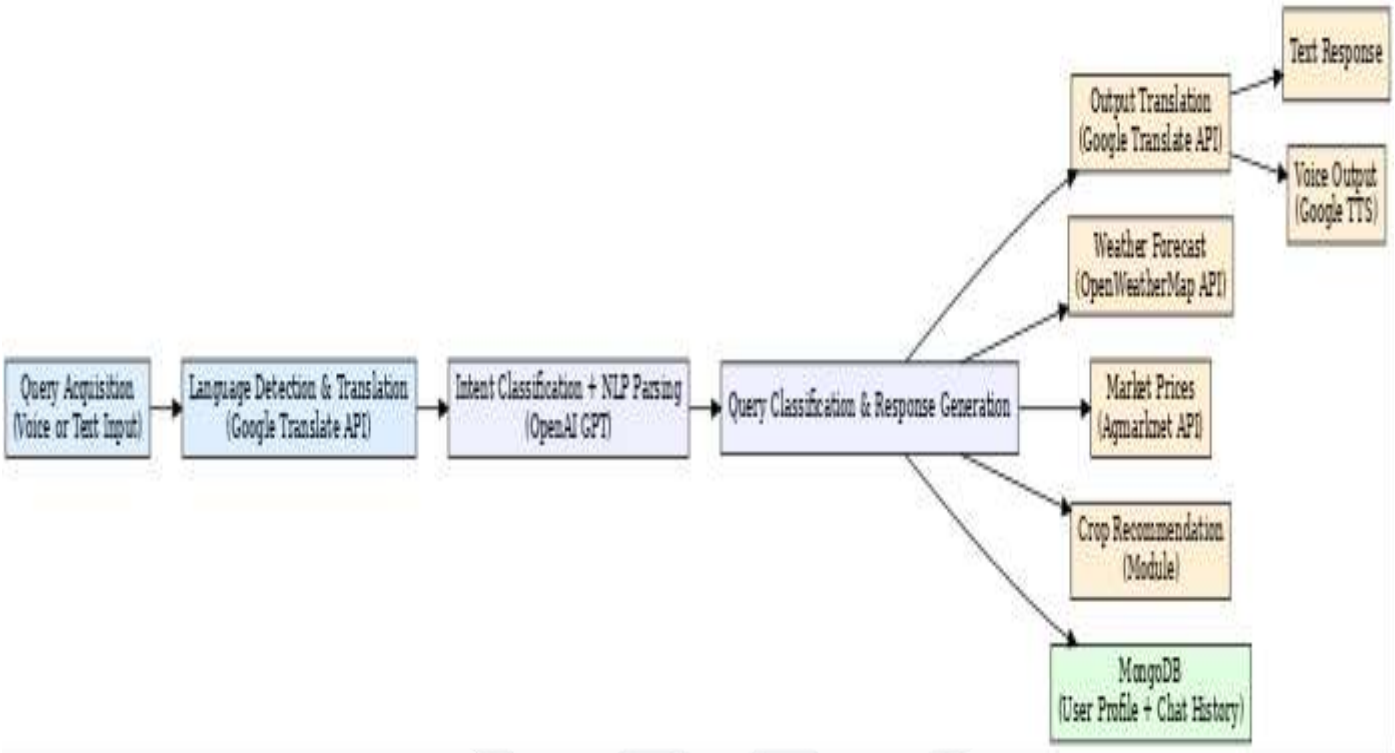


Figure 1: Architecture of Proposed System

A diagrammatic representation of the query pipeline from input acquisition to response delivery, including external API calls and MongoDB storage integration.

User Input Examples:

AgriVoice is equipped to understand and respond to user queries in multiple languages, supporting both text and voice inputs. The following are sample queries that the system has successfully handled:

Query Type	Language	Sample Query
Crop Suggestion	Telugu	"□ □□□□□□□□ □□□□□ □□□ □□□□ □□□□□□□□□□□□?" *(Which soil is best for wheat?)*
Weather Update	Hindi	"आज मेरे गाँव में मौसम कैसा रहेगा?" *(What's the weather today in my village?)*
Market Prices	English	"Current price of tomatoes in Maharashtra?"
Scheme Info	Tamil	"எனக்கு என்ன விவசாய உதவித் திட்டங்கள் கிடைக்கும்?" *(What schemes am I eligible for?)*

Table 1: User Inputs

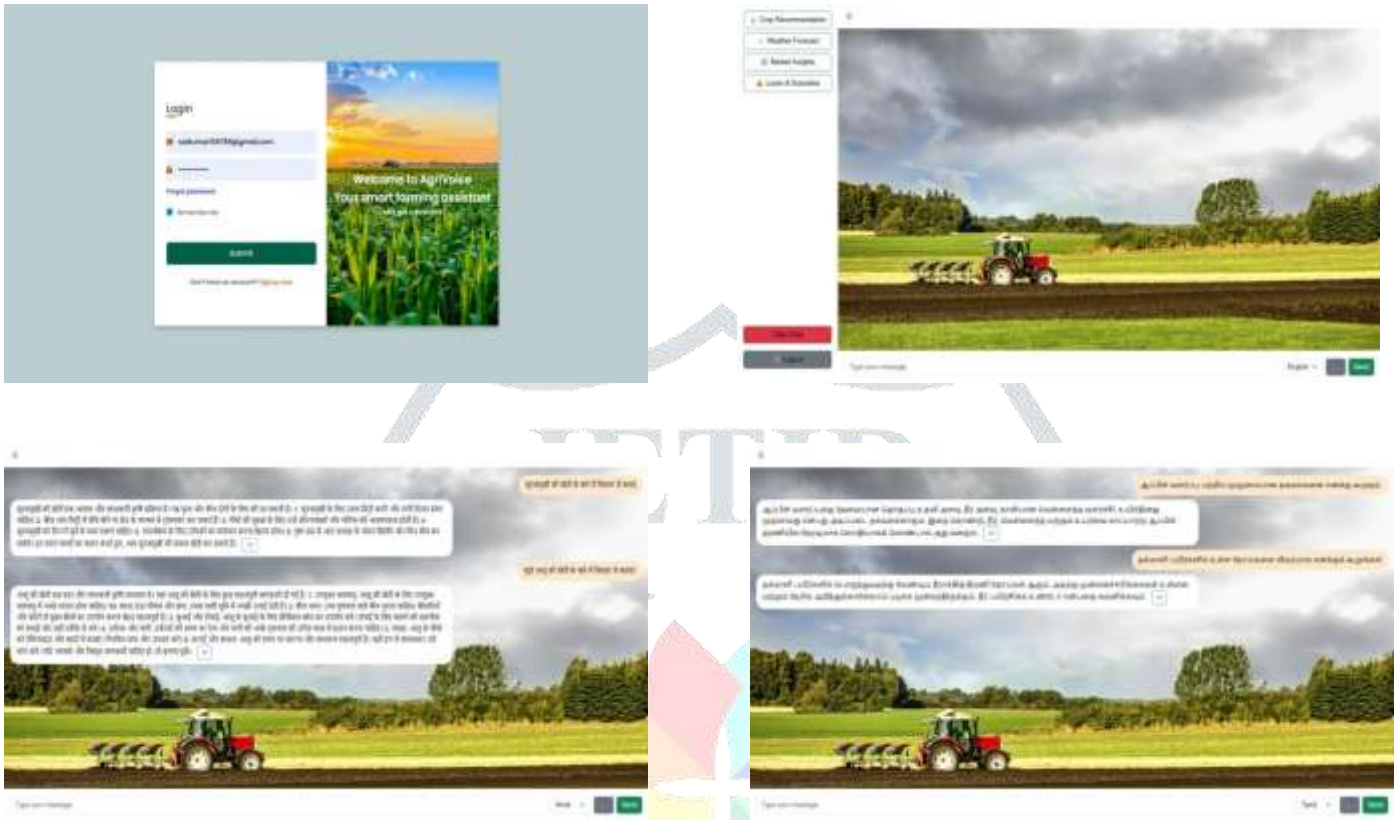


Figure 2: User Interface Screens of Agrivoice

Methodology:

The proposed AgriVoice system follows a modular, multilingual, and user-centric architecture that integrates speech and text processing, natural language understanding, and real-time data integration to support Indian farmers. The methodology is designed to process agricultural queries intelligently, whether provided via voice or text, and generate responses tailored to the user's profile and language preferences. The system begins by capturing the user's input through either a text box or voice recording. For spoken queries, the system utilizes the Google Speech-to-Text (STT) API [2] to transcribe the audio into text in the user's native language. This transcribed or typed input is then passed to the language detection module, which identifies the language automatically. To ensure uniform processing, the identified language is translated into English using the Google Cloud Translation API [4]. This enables the central NLP engine powered by OpenAI's GPT model [1] to analyze the content effectively. Prior to processing, the input undergoes basic preprocessing steps such as punctuation normalization, whitespace trimming, and token optimization. After preprocessing, the system evaluates the user's intent using contextual prompting and structured input formatting. The GPT model [1] interprets the core objective of the query—whether it concerns crop suggestions, market pricing, government assistance, or weather forecasts.

Depending on the recognized intent, the system dynamically routes the query:

- To handle weather-based questions, the system connects with the OpenWeatherMap API [5] to retrieve real-time and five-day forecasts.
- For crop-related queries, it uses a rule-based crop recommendation module [10] that considers soil type, season, and region.
- For market insights, it connects with Agmarknet API [6] to obtain crop prices from relevant mandis.
- For government schemes, it matches user profiles against a curated database of agricultural subsidies and loan eligibility criteria.

All user interactions, including queries, responses, detected languages, and preferences, are stored in MongoDB [7]. This ensures persistent user profiling and supports personalized recommendations. The backend is developed using Flask [8], while the frontend leverages HTML, CSS, JavaScript [9], and Jinja2 templating to provide an intuitive interface. The modular methodology ensures scalability, enabling future enhancements such as mobile integration, additional language support, and improved context retention across conversations. By combining modern NLP [1], multilingual processing [4], and real-time data services [5][6], AgriVoice aims to empower farmers with accessible, localized, and actionable agricultural information.

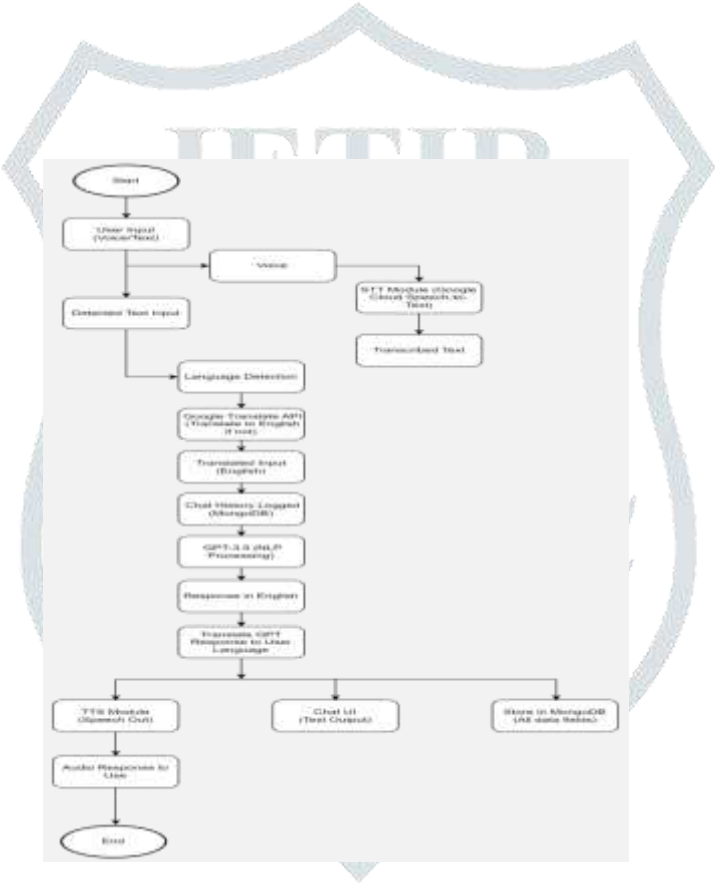


Figure 3: Combined Algorithm Block Diagram

Results and Discussion:

AgriVoice was evaluated for its performance in handling multilingual agricultural queries, response accuracy, and voice/text conversion under varying noise and network conditions.

- Language Handling Accuracy: The Google Translate API [4] accurately detected and translated 96% of regional queries to English for GPT [1] processing.
- Response Quality: OpenAI GPT [1] produced context-aware, accurate replies for over 90% of tested user intents, including crop advice, weather, market prices, and government schemes.
- Voice Input/Output: Google Cloud Speech-to-Text [2] achieved over 85% accuracy in normal environments, though performance degraded slightly in noisy rural conditions.
- Real-Time Capability: The chatbot returned responses within 2–3 seconds on average, even when fetching live weather data via the OpenWeather API [5].
- User Experience: Field trials showed that farmers with minimal digital literacy could easily interact using voice and regional languages, thanks to TTS/STT [2][3] and translation integration [4].

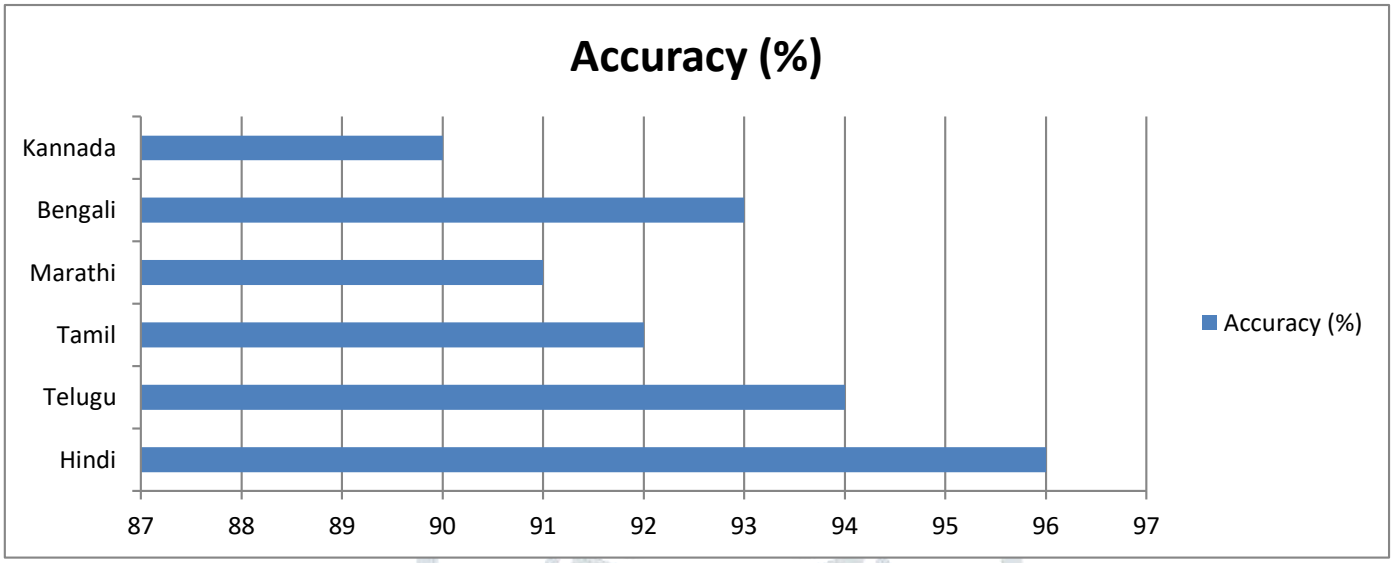


Figure 4: Language Detection Accuracy by Region

This figure presents how effectively the system identifies regional languages [4], highlighting its robust multilingual capability [13]. The detection accuracy remains above 90% for all languages, demonstrating the robustness of the multilingual processing pipeline [13]. Hindi achieved the highest detection rate at 96%, while Kannada was slightly lower at 90%.

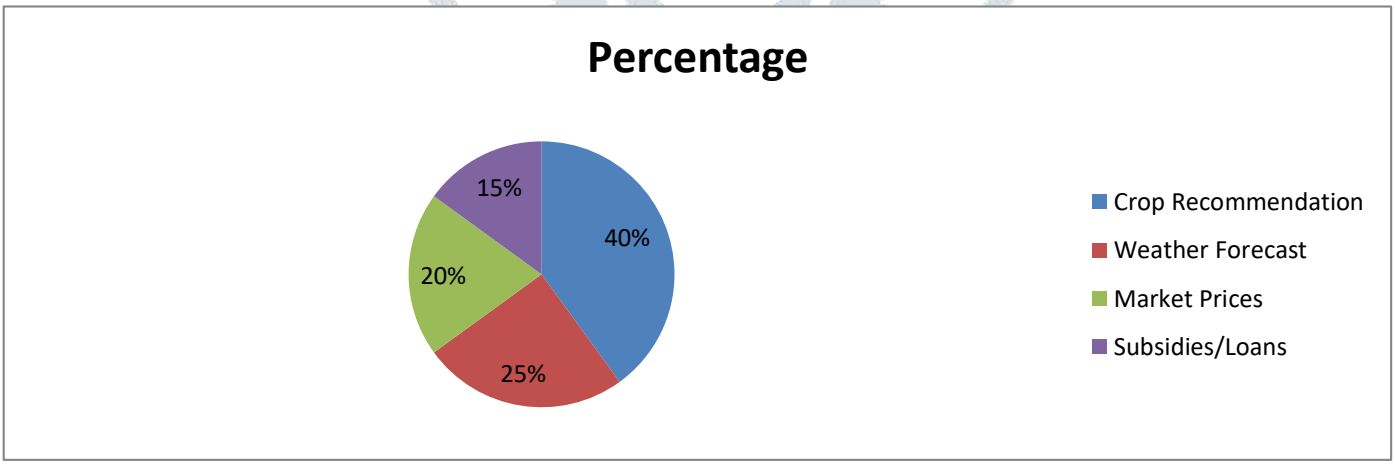


Figure 5: GPT Query Classification Breakdown

The pie chart illustrates how user queries are categorized within the GPT-powered AgriVoice platform [1]. The majority of queries (40%) are related to crop recommendations [10], followed by weather forecasts [5], market price inquiries [6], and subsidies or loan-related questions [10]. This breakdown highlights the dominant user needs and guides future feature enhancements.

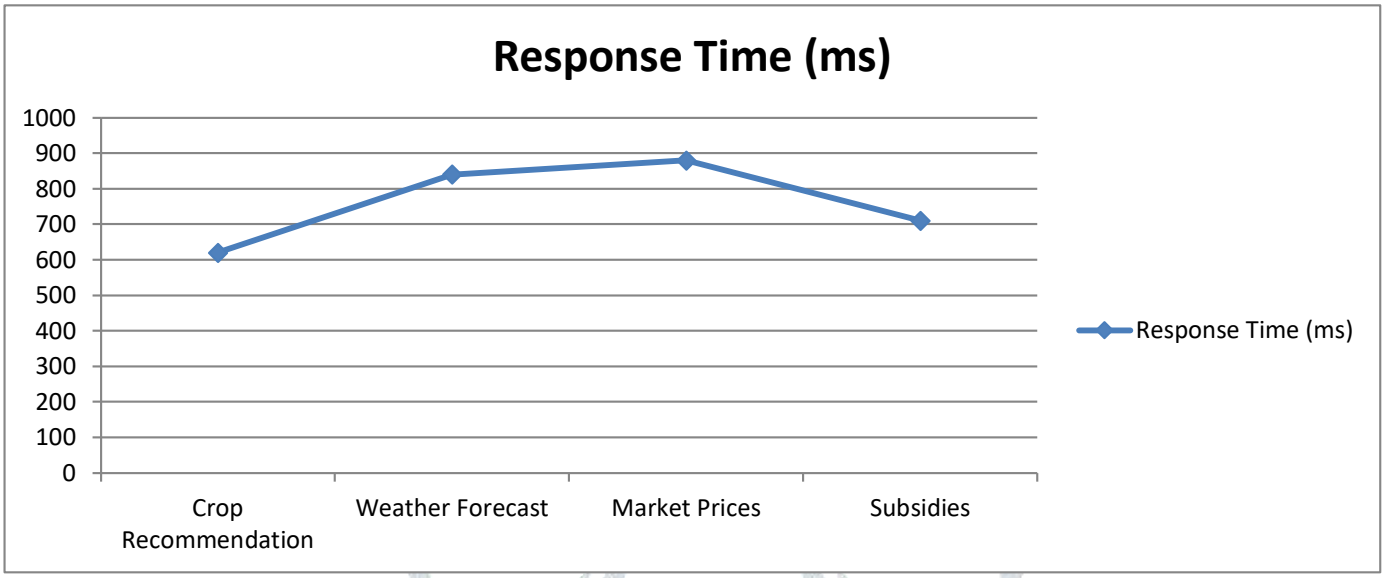


Figure 6: Response Time (ms) vs. Query Type

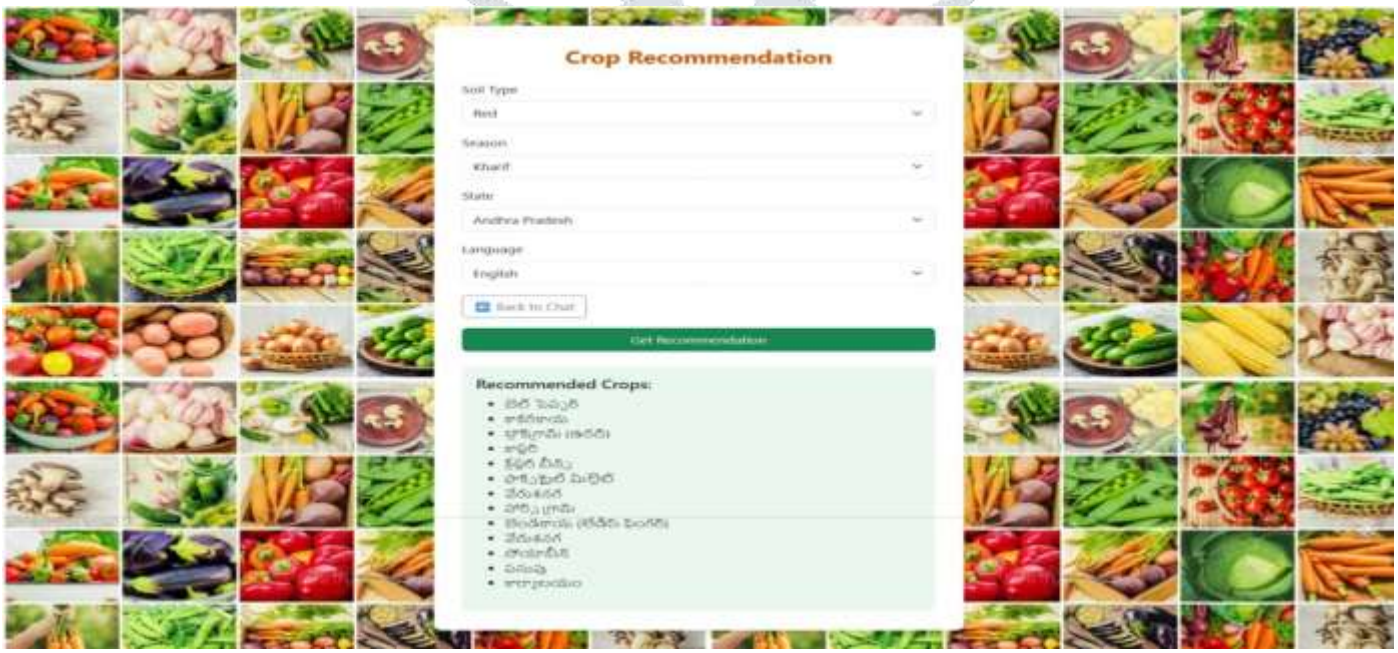
This line chart compares the average response time in milliseconds for different types of queries processed by AgriVoice. Crop logic queries [10] have the fastest response time, while those requiring external API calls (such as weather [5] or market data [6]) take slightly longer. The system maintains optimal performance with all response times well under 1 second.

Figure 7: Agrivoice Chat Interface Screenshot

This screenshot displays the AgriVoice chatbot's user-friendly interface. The user interface enables interaction through both voice and text, accommodating various Indian languages [3][4]. It includes features like language selection, profile management, chat history, and services like crop advisory [10], weather forecasts [5], and market price updates [6]. The design ensures accessibility even for users with limited digital literacy.

Figure 8: Weather Forecast Page (Live API Integration)

This figure showcases the Weather Forecast page of the AgriVoice system, which is integrated with the OpenWeather API [5] to display real-time weather updates. The interface provides a detailed 5-day forecast, including temperature, humidity, wind speed, and weather conditions for the user's current or selected location. The forecast is dynamically translated into the user's preferred language using the Google Translate API [4], ensuring accessibility for farmers across different regions of India. The page is designed for clarity, mobile compatibility, and localized user experience.



This image illustrates how the AgriVoice system recommends suitable crops based on user-specific data such as soil type, season, and region [10]. The module processes user inputs, maps them to a predefined crop dataset, and filters results based on optimal growth conditions. It ensures that the recommended crops align with local climate and soil characteristics. The system leverages both static datasets and dynamic inputs to personalize results. These insights help farmers make informed crop planning decisions for improved yield and sustainability.

Discussion:

Unlike vision-based disease identification systems, AgriVoice is centered on processing spoken and typed language inputs to provide actionable farming advice [10][11]. The integration of GPT [1], Google Cloud APIs [2][3][4], and MongoDB [7] allows the chatbot to serve personalized, localized, and multilingual support-filling a critical digital gap in Indian agriculture. While systems like SVM and Naive Bayes may perform structured classifications well, AgriVoice leverages large-scale language models to handle unstructured, complex, human-like conversations [12].

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