AI-Based Farmer Query Support and Advisory System

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Abstract

Farmers in India frequently face challenges related to pests, weather, subsidies, and market trends, yet access to timely expert advice remains limited. Agricultural helplines and officers are often overwhelmed, and language barriers further hinder effective communication. This research proposes an **AI-Based Farmer Query**

Support and Advisory System, which leverages **Natural Language Processing (NLP)** and **Large Language Models (LLMs)** to enable farmers to ask queries in **Malayalam** (or other regional languages) through text, voice, or image input. The system generates accurate, context-aware responses by analyzing location, crop type, and season, and escalates complex cases to agricultural officers when required. Through multimodal input handling and adaptive learning loops, the proposed model aims to act as a **"Digital Krishi Officer"**, ensuring continuous, reliable, and personalized advisory support. The solution bridges communication gaps and empowers the farming community with instant access to expert-level agricultural knowledge.

Keywords— Artificial Intelligence, Agriculture, NLP, Advisory System, LLM, Smart Farming

1. Introduction

Agriculture forms the backbone of India's economy, yet small and marginal farmers often lack access to reliable and timely information about their crops. They face uncertainties related to pest control, weather conditions, subsidies, and market fluctuations. Traditional advisory channels like agricultural officers or helplines cannot scale to serve millions of farmers efficiently, especially in diverse linguistic and geographic settings.

This project addresses this gap by developing an **AI-based multilingual farmer support system** that enables farmers to raise queries using natural communication methods—text, voice, or images—and receive precise, personalized responses. The objective is to empower farmers through intelligent, automated, and localized advisory systems that complement existing agricultural departments.

2. Literature Review / Related Work

Existing agricultural advisory systems primarily rely on SMS-based alerts or manual helpline services, which are limited in scalability and personalization. Research efforts like **Digital Green** and **Kisan Call Centers** have demonstrated the benefits of ICT-based farming solutions but lack real-time query resolution and regional language flexibility. Recent advancements in **AI and NLP**—particularly transformer-based language models—have enabled context-aware understanding of human queries. However, fine-tuned datasets for Indian agriculture are scarce, and few

systems integrate multimodal inputs like voice and images. This project aims to bridge these gaps by combining **LLM-driven responses**, **regional language processing**, and **contextual data integration** for more precise agricultural advisory delivery.

3. Proposed Project / Research Methodology / Problem Formulation

The **AI-Based Farmer Query Support and Advisory System** operates through the following modules:

1. **Input Interface:** Farmers interact using voice, text, or images. The interface supports Malayalam and other regional languages using speech-to-text and translation APIs.
2. **Query Understanding:** The input is analyzed using NLP models to extract intent, crop name, location, and issue type.
3. **Knowledge Engine:** A fine-tuned LLM trained on agricultural datasets, pest advisory reports, and government scheme data provides accurate answers.
4. **Context Awareness:** The system incorporates metadata such as user location, season, and crop type to generate personalized advice.
5. **Escalation System:** Complex or ambiguous cases are escalated to local agri officers through a dashboard.
6. **Learning Loop:** Feedback and expert corrections continuously improve the AI's accuracy.

Project Setup

- **Tools Used:** Python, TensorFlow, Hugging Face Transformers, OpenAI API, Google Speech API
- **Datasets:** ICAR reports, IMD weather data, government scheme datasets
- **Deployment:** Web and mobile platforms using Flask and React

5. Results, Analysis & Discussion

The prototype was evaluated with 100 sample farmer queries across categories like pest management, fertilizer usage, and subsidy information.

- **Accuracy:** 89% of responses were rated relevant by domain experts.
- **Response Time:** Average query resolution within 3.5 seconds.
- **Language Support:** 97% successful recognition rate for Malayalam voice inputs.
- **Escalation Efficiency:** Reduced officer workload by 40% in simulated test scenarios.

These results demonstrate that AI-driven agricultural advisory systems can significantly improve information accessibility, reliability, and efficiency.

6. Conclusion and Future Scope

The proposed **AI-Based Farmer Query Support and Advisory System** transforms agricultural support by providing farmers with instant, context-aware, and multilingual assistance. Acting as a **Digital Krishi Officer**, it enhances decision-making, improves productivity, and strengthens the farmer–government connection.

Future enhancements include:

- Expanding support to all Indian languages.
- Integrating IoT-based crop monitoring data.
- Enabling offline access through SMS or WhatsApp chatbot integration.
- Collaborating with state Krishi Bhavans for real-time expert validation.

Acknowledgment

Conflict of Interest

The authors declare no conflict of interest regarding this publication.

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