1. Introduction

In numerous developing countries, agriculture forms the cornerstone of economic stability and food security. The agricultural sector, dominated by small-scale farmers, plays a significant role in the economies of these nations. However, these farmers frequently encounter substantial barriers that impede their operational efficiency and sustainability. Among the most pressing challenges are limited access to essential agricultural inputs and affordable financial credit. Addressing these barriers is crucial for enhancing the productivity and livelihoods of small-scale farmers, thereby ensuring food security and economic stability on a broader scale.

Agricultural inputs such as quality seeds, fertilizers, and pest control measures are essential for achieving high crop yields. Small-scale farmers often struggle to access these inputs due to high costs and inadequate supply chains. Governmental support is frequently insufficient, leaving farmers reliant on less effective traditional farming practices. Consequently, the integration of advanced agricultural practices, such as precision farming, remains a significant challenge for these farmers due to the high upfront investment required for technology adoption.

Financial constraints further exacerbate the difficulties faced by small-scale farmers. Access to affordable credit is limited, as many financial institutions in developing countries require collateral that small-scale farmers often do not possess. As a result, farmers frequently rely on informal lending sources, which charge exorbitantly high-interest rates, perpetuating a cycle of debt and financial instability. This lack of financial inclusion prevents farmers from investing in essential agricultural inputs and adopting modern farming practices, perpetuating low productivity and poverty in rural agricultural communities.

In the context of these challenges, technology-driven solutions hold promise for addressing some of these fundamental issues. The advent of AI and Machine Learning (ML) offers innovative opportunities to tackle financial and agricultural challenges. Leveraging AI for credit scoring can provide a more accurate assessment of a farmer's creditworthiness, facilitating access to affordable loans. Additionally, AI-driven precision agriculture can offer tailored recommendations for agricultural inputs, significantly improving productivity and sustainability.

This project aims to develop a platform that leverages AI to provide credit scoring for farmers and tailored agricultural input recommendations. By collecting and analysing data such as farm size, crop type, soil quality, and weather conditions, machine learning models will predict optimal agricultural inputs and assess the farmer’s ability to repay loans. The platform will offer credit assessment hence enabling farmers to be given affordable payment plans, enabling them to purchase necessary inputs with manageable upfront payments and instalments.

The anticipated outcome is a user-friendly platform that assists low-income farmers by improving access to agricultural inputs and credit, thereby enhancing their agricultural practices for greater sustainability and productivity. This technology-driven support is expected to empower low-income farmers, contribute to the economic growth of the target communities, and ensure long-term food security.

By addressing the intertwined issues of limited credit access and insufficient agricultural inputs, this AI-driven platform provides a comprehensive solution to enhance the livelihoods of small-scale farmers in developing countries.

2. Methodology

The project leverages a combination of predictive analytics and data science and programming techniques. By utilizing AI, the platform aims to automate the decision-making process for agricultural inputs and financial credit assessments, thereby increasing agricultural productivity and financial inclusion.

2.1 Data Collection and Preparation

Soil information is obtained from the SoilsGrid database and the also via an Application Interface (API) SoilsGrid API which provides global soil information crucial for agricultural insights.

Weather Data is derived from historical records to predict future conditions affecting farming activities.

Yield Data is synthesized to train the models where real data was unavailable, ensuring comprehensive coverage of possible scenarios.

2.2 Machine Learning and AI Models

The Machine learning algorithm used for the credit scoring and fertilizer recommendation models is the Random Forest Regressor.

The OpenAI Assistant API is used to power the FarmAI chatbot customized to process agricultural queries.

2.3 Software Architecture

The platform is designed to have a backend to handle requests and core functionalities and a frontend that is client facing to take in user input and display results from the backend.

The backend is developed using python whereas the frontend is developed using React. Below is the system architecture and component diagrams.

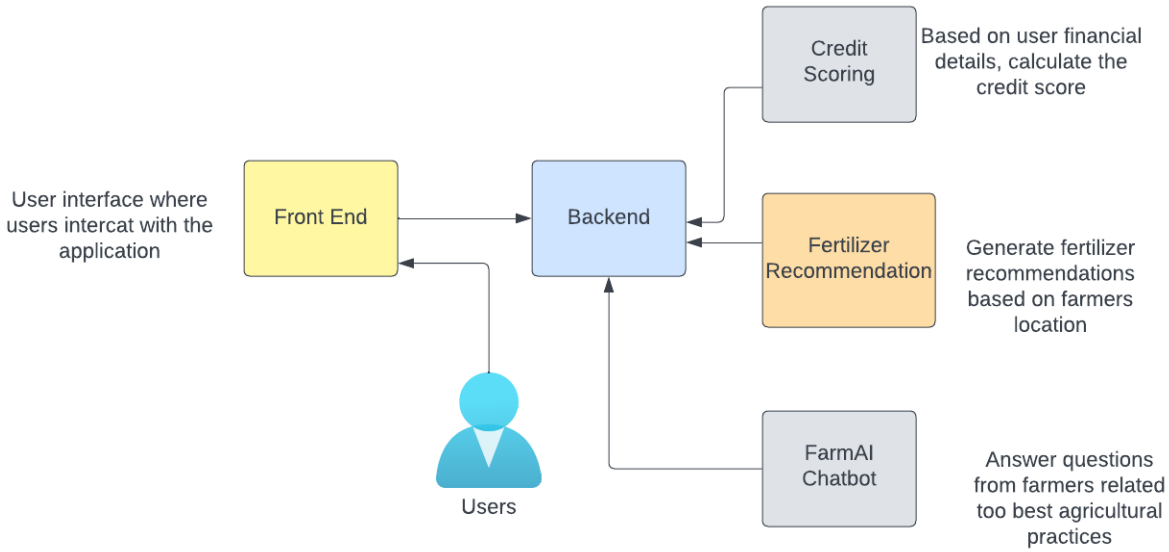

Figure 1 System architecture

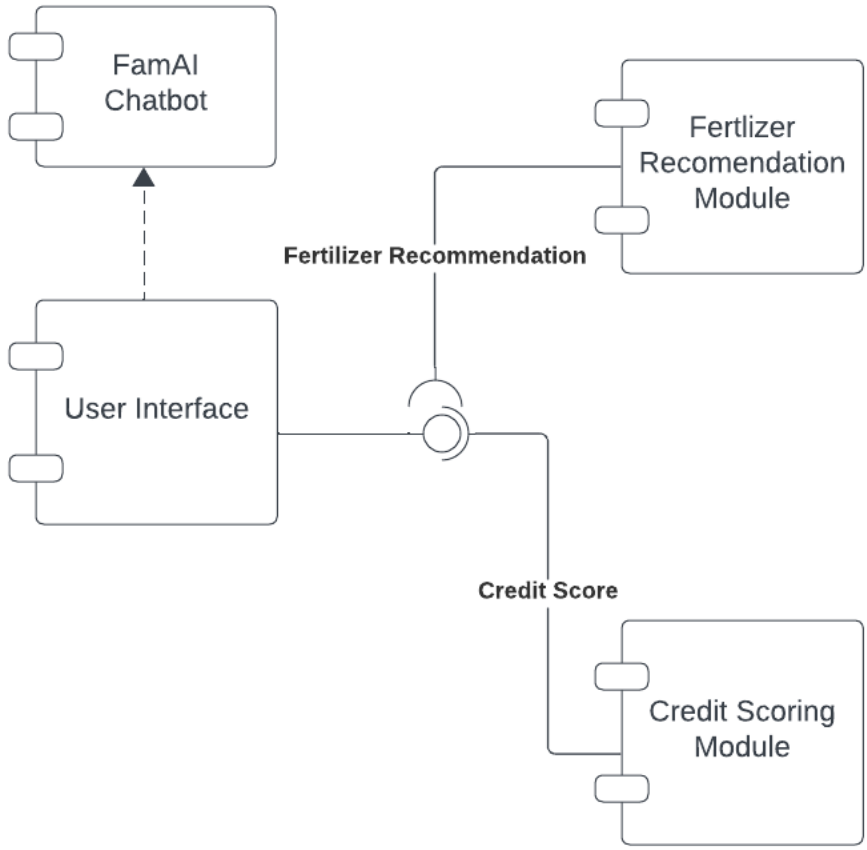

Figure 2 Component diagram