AI based model to characterize soil and suggest suitable organic fertilization techniques

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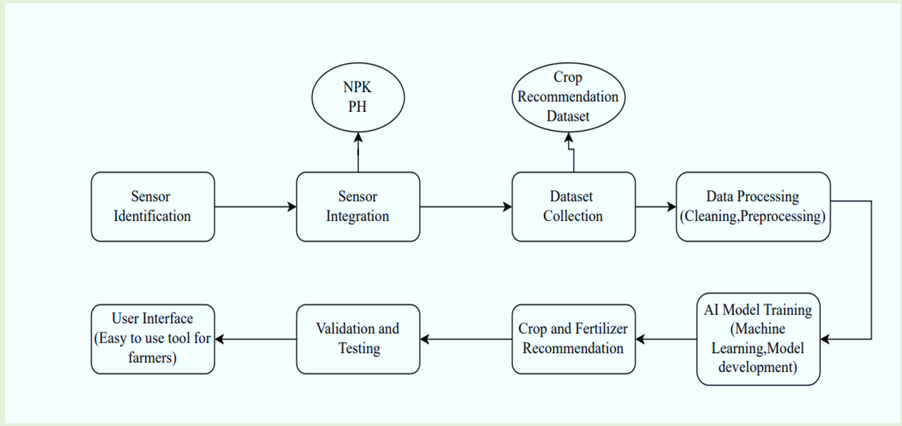
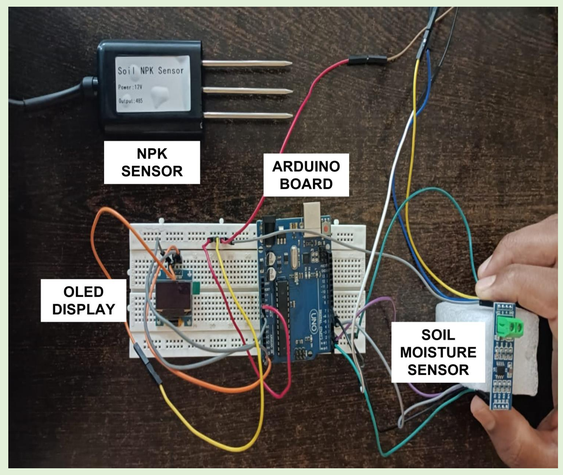
Abstract

- AI-based model for characterizing soil properties and providing two key recommendations. Firstly, based on the levels of **Nitrogen (N), Phosphorus (P), Potassium (K), and pH**, the model suggests the most suitable crops to cultivate.
- Secondly, it **recommends appropriate organic fertilization** techniques to enhance agricultural productivity and sustainability. The system utilizes machine learning algorithms to analyze the physical, chemical, and biological attributes of soil samples.
- The proposed work achieved an **accuracy of 81.2% for crop recommendation**. A graphical user interface(GUI) was also proposed for real time application. Our overarching objective is to improve crop yield and soil health through data driven organic fertilization, promote sustainable agriculture by minimizing chemical fertilizer dependence, and offer a user-friendly interface for farmers.

Methods

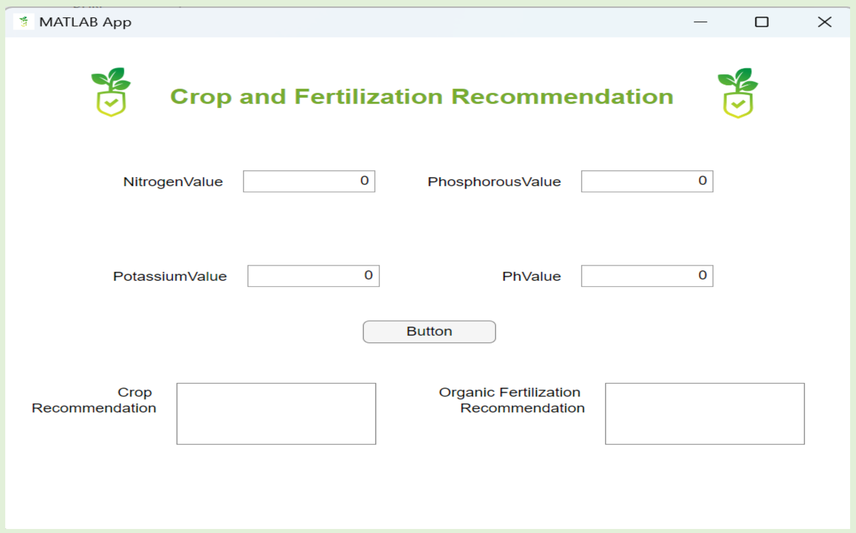




Result: MATLAB GUI and Experimental Setup

TABLE III
ACCURACIES OF DIFFERENT MODELS

Sl. No.	Model	Validation Accuracy(%)
1	**Fine Decision Trees**	**81.6**
2	Medium Decision Trees	42.3
3	Medium Gaussian SVM	79.3
4	Fine Gaussian SVM	72.5
5	Fine kNN	74.8
6	Medium kNN	73.2



Background

- The models for characterization, proposing the adequate techniques of organic fertilization based on AI, represent the state of the art in precision agriculture.
- Among the important concerns of sustainable farming is soil health maintenance, which an understanding of soil composition, texture, and nutrient level for optimizing crop yield.
- In the traditional method, soil analysis consumes a lot of time and resources.
- Contrasting that, AI models are capable of processing large volumes of data on soil in short order.
- Such models can then recommend specific organic fertilizers to improve fertility and reduce environmental impacts, thus addressing the needs of the soil.
- Sustainability and Productivity: The AI model supports eco-friendly farming by improving soil health, boosting crop yields, and contributing to long-term sustainable agriculture.

Future Perspectives

- **Cloud-Based Data** ☁️🌱 – Integrating soil data with cloud computing enables real-time monitoring, remote access for farmers.
- **Farmer-Friendly Applications** – Develop a mobile app with a simple interface for farmers to get instant recommendations.
- **Sustainable Agriculture** – Focus on climate adaptation, reducing chemical fertilizers, and promoting long-term soil health.

Impact on Society

- **Empower Farmers** 👩‍🌾 – Provides data driven insights for better crop selection and organic fertilization , improving yield and income.
- **Promotes Sustainability** 🌱 – Reduces chemical fertilizer dependence, improving soil health and protecting the environment
- **Enhances food security** 🍚 – Optimizes agricultural productivity , ensuring a stable and sufficient food supply

To know more

GitHub link: Link