

Agro AI

Group - 40

Agro AI seeks to address the challenges faced by the farmers in a country with a population of 1.4 billion. This project involves intelligent decision-making considering field demographics, crop factors, and overall farm health to achieve optimal yields. The project takes the form of a website offering Crop Recommendation, Fertilizer Recommendation, and Pesticide Recommendation based on site-specific parameters.

Project Overview

Agro AI utilizes machine learning (ML) and Reinforcement learning (RL) models to provide real-time predictions for Crop Recommendation based on parameters like N(Nitrogen), P (Phosphorus), K(Potassium), temperature, rainfall, relative humidity, and pH. The irrigation model starts the irrigation when soil moisture falls below a particular level. The Fertilizer Prediction feature suggests suitable fertilizers for a chosen crop, while the Pesticide Recommendation employs a Deep Learning (DL) model, specifically Convolutional Neural Network (CNN), to identify pests from uploaded images and recommend corresponding pesticides.

Problem Definition

Agro AI addresses key challenges faced by Indian farmers:

1. Enhancing productivity without degrading soil.
2. Assisting farmers in selecting the right crop based on soil requirements and environmental factors.
3. Providing guidance on organic and standard fertilizers based on soil needs.
4. Combating soil degradation caused by imbalanced fertilization.
5. Addressing annual crop losses due to pests.

Problem Objectives

Agro AI's objectives align with the identified problems:

1. Implementing precision agriculture to guide crop selection based on site-specific parameters.
2. Developing a recommendation system using ensemble models for accurate and efficient crop suggestions.
3. Recommending organic fertilizers based on N, P, K values and crop.
4. Identifying pests and suggesting appropriate pesticides adhering to ISO standards.
5. Designing a user-friendly web application to achieve the above objectives.

Project Outcomes and Deliverables

The project aims to deliver a web application with three modules:

1. Crop Recommendation: Input values for N, P, K, temperature, humidity, rainfall, and pH to receive a prescribed crop.
2. Fertilizer Recommendation: Input values for N, P, K, and selected crop to receive corresponding organic fertilizer suggestions.

3. Pesticide Recommendation: Upload a picture of the pest or manually select the pest for identification and receive recommended pesticides.
4. Irrigation controller : it can start the irrigation when soil moisture level fall below the threshold and also can increase or decrease the irrigation rate.

Assumptions and Constraints

Agro AI operates under certain assumptions and constraints:-

- 1) Agro AI supports 22 crops:- apple, banana, blackgram, chickpea, coconut, coffee, cotton, grapes, jute, kidney beans, lentil, maize, mango, mothbeans, mungbean, muskmelon, orange, papaya, pigeon peas, pomegranate, rice, watermelon.
- 2) The system supports 10 pests: aphids, armyworm, beetle, bollworm, earthworm, grasshopper, mites, mosquito, sawfly and stem borer.
- 3) The user can opt for uploading image of the pest or manual selection of the pest: In case of first choice, any other picture of pest uploaded (apart from 10 supported pests) will display the result which is close resemblance with pests supported and in the latter case, the user can only make a selection among 10 pests.
- 5) Internet connection is required.
- 6) Realistic values should be entered for getting the best result.
- 7) The maximum file size in case of image upload is 2 GB and maximum dimensions as per Webp format are: 16383 x 16383.

Functional Requirements

Agro AI's functional requirements are outlined for each module:

1. Crop Recommendation: Recommends crops based on user-input parameters.
2. Irrigation Model : it can maintain the irrigation in the farm according to soil moisture.
3. Fertilizer Recommendation: Recommends organic fertilizers based on user-input parameters.
4. Pesticide Recommendation: Identifies pests from uploaded images or manual selection and recommends corresponding pesticides.

Methodology Adopted

Agro AI's three modules are implemented through a systematic approach:

1. **Crop Recommendation**: Involves data acquisition, user input, RL model, and recommendation based on the loaded .pkl file.
2. **Fertilizer Recommendation**: Comprises data acquisition, user input, calculation of differences, and recommendation based on a dictionary solution.
3. **Pesticide Recommendation**: Encompasses data acquisition, cleaning, DL model creation, and recommendation based on identified pests and a dictionary solution.
4. **Irrigation Model** : It is a RL based model in which q learning is used mostly .

Tools and Technology Used

Agro AI employs various tools and technologies, including

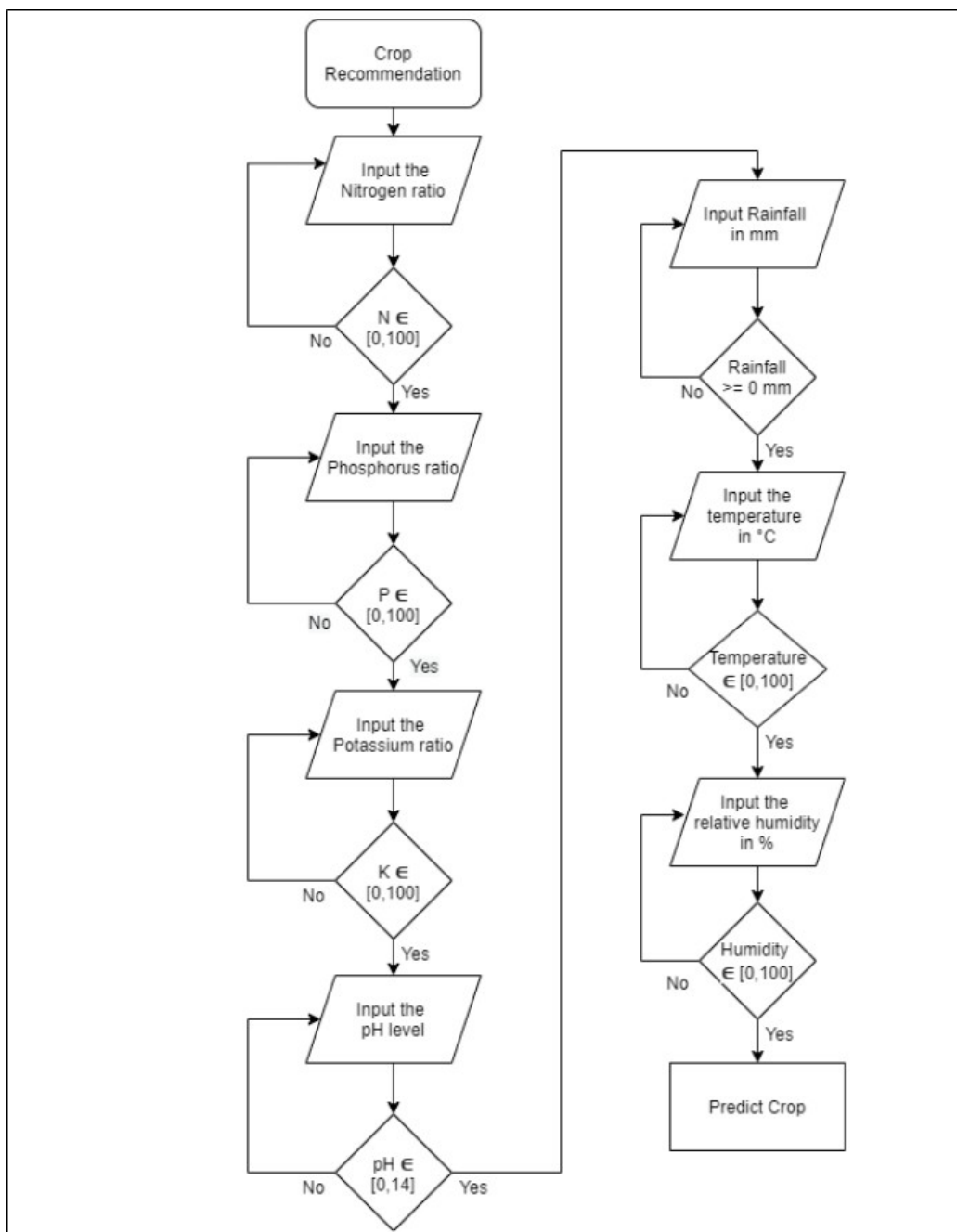
- numpy
- pandas
- flask
- pickle
- pymongo
- neural networks (keras, tensorflow, CNN)
- ssl

- passlib

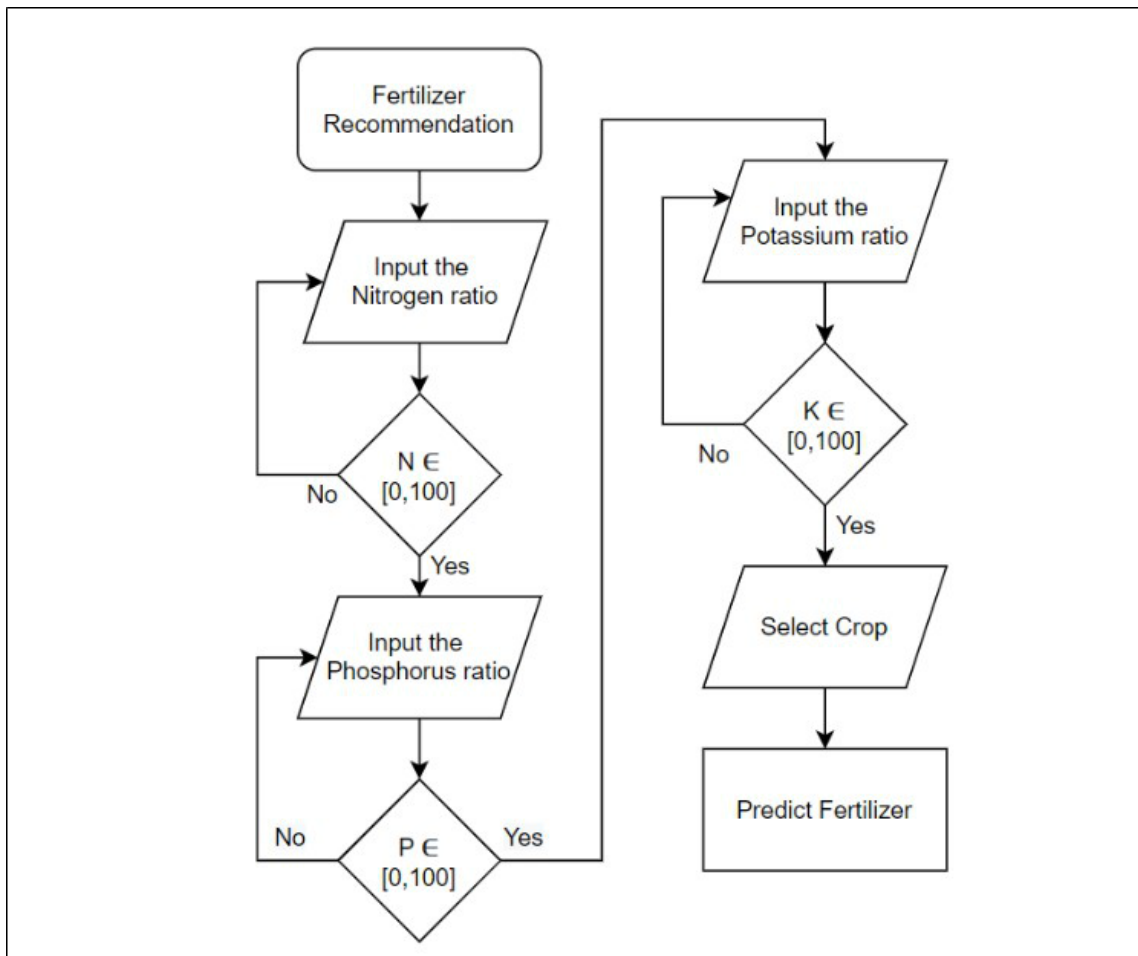
- PyCharm
- OS
- matplotlib.pyplot
- h5
- sklearn

Flow Networks:-

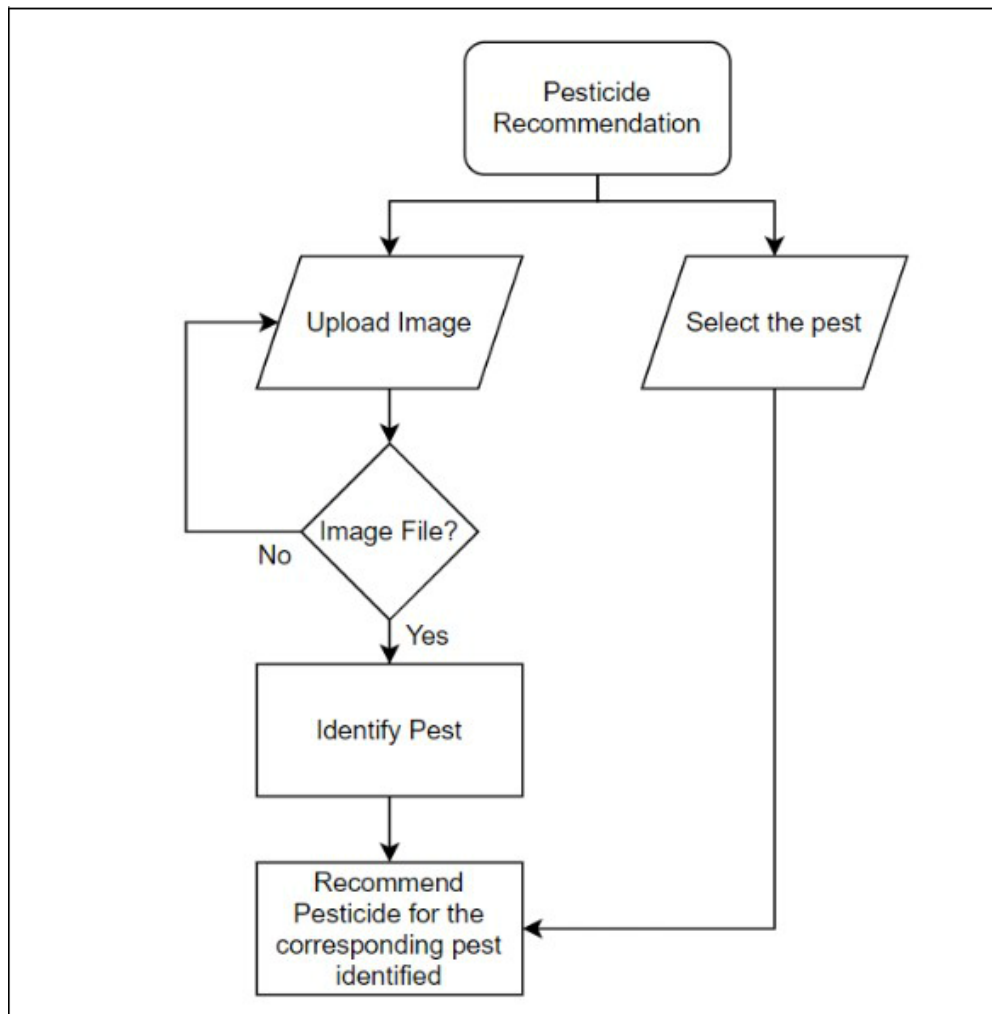
1) Crop Recommendation

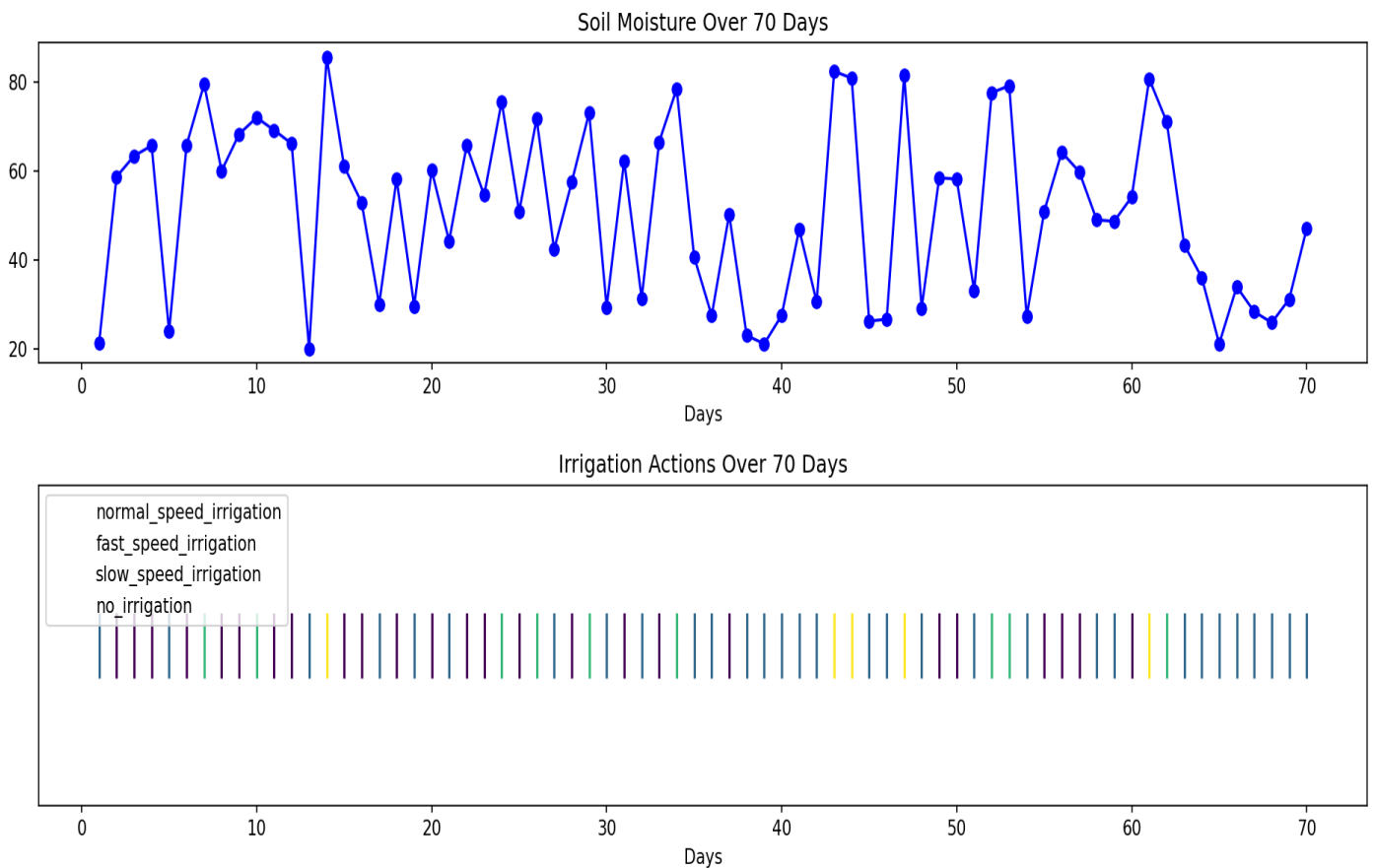


2) Fertilizer Recommendation :-



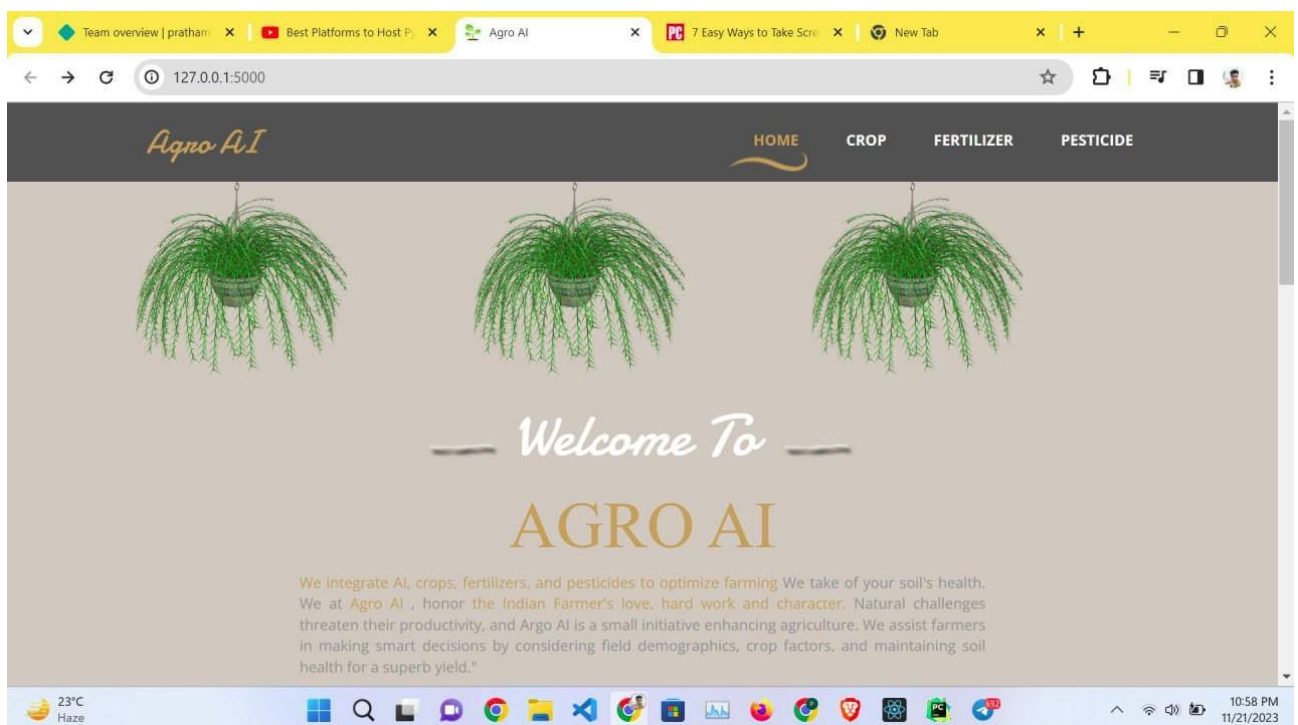
3) Pesticide Recommendation :-

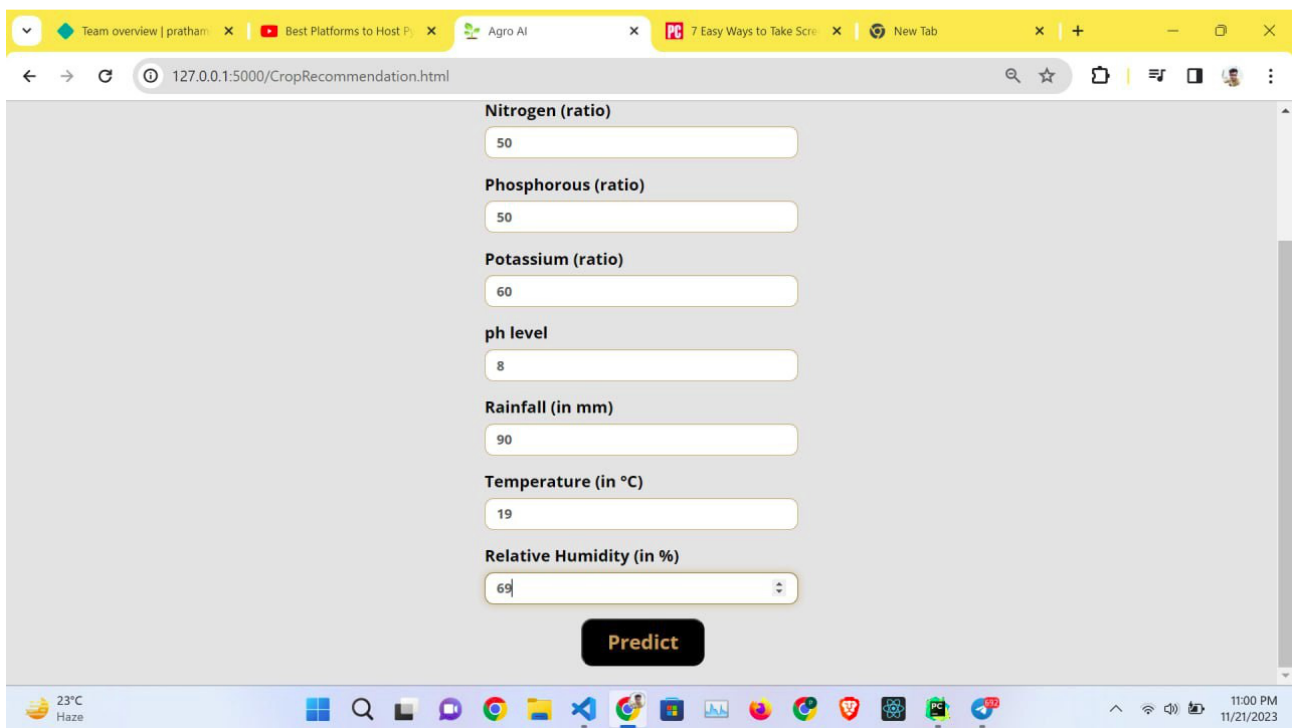
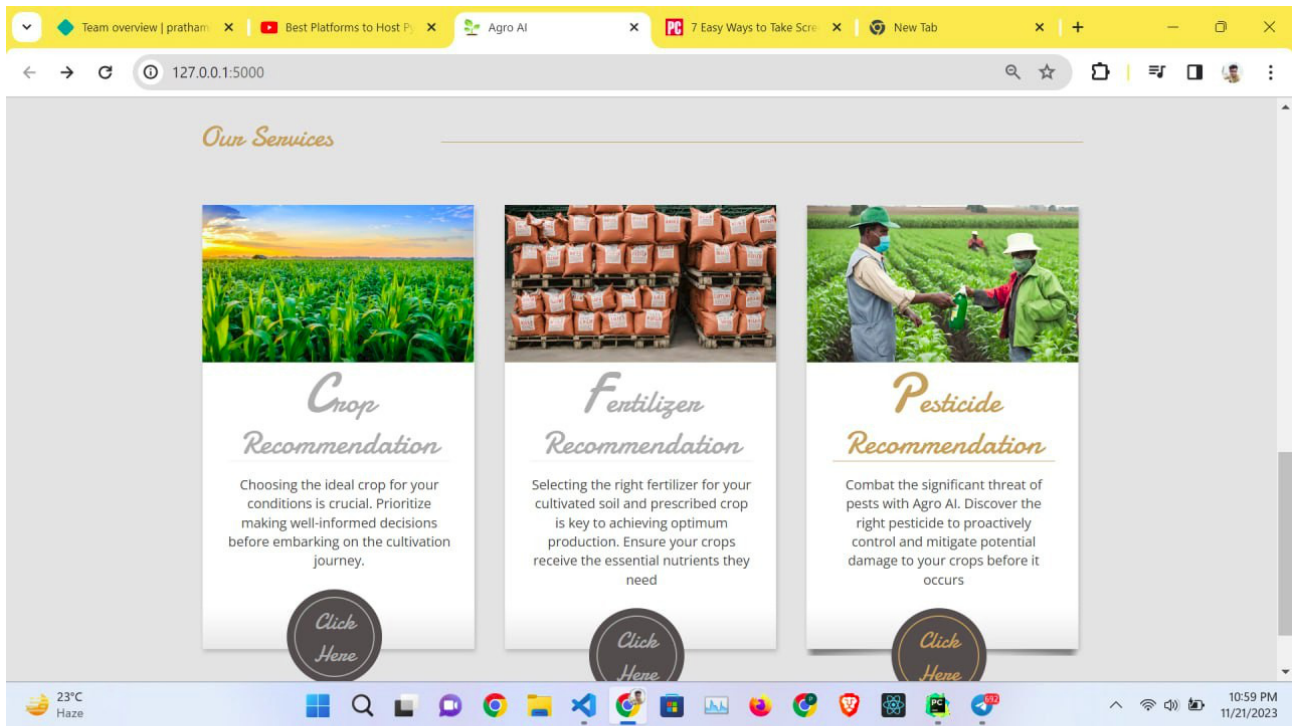




Screenshots

Here are some screenshots of Agro AI:-






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127.0.0.1:5000/crop_prediction

Agro AIHOMECROPFERTILIZERPESTICIDE

You should grow *papaya* in your farm



23°C Haze



11:00 PM11/21/2023

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127.0.0.1:5000/FertilizerRecommendation.html

Agro AIHOMECROPFERTILIZERPESTICIDE

Get informed advice on fertilizer based on soil

Nitrogen (ratio)

Phosphorous (ratio)


Potassium (ratio)

Crop you want to grow

watermelon

Predict

23°C Haze



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127.0.0.1:5000/fertilizer-predict

Agro AI

HOME CROP FERTILIZER PESTICIDE

Difference between desired value of N and your farm's N value is 20.0

The nitrogen (N) level in the soil is low.

Please consider the following suggestions:

1. **Add Sawdust or Woodchips:** Incorporate sawdust or fine woodchips to your soil, as the carbon content helps absorb excess nitrogen.
2. **Nitrogen-Feeding Plants:** Plant crops like tomatoes, corn, broccoli, and spinach that thrive on nitrogen.
3. **Watering:** Soak your soil to leach nitrogen deeper, reducing its availability for plants.
4. **Sugar:** Limited studies suggest that adding sugar can potentially reduce nitrogen levels in the soil.
5. **Add composted manure** to the soil.
6. Plant nitrogen-fixing plants like peas or beans.
7. **Use NPK Fertilizers with High N Value.**
8. **Do Nothing:** If plants are already thriving, letting them absorb nitrogen can naturally amend the soil for future crops.

Difference between desired value of P and your farm's P value is 60.0

The phosphorus (P) value in the soil is high.

Please consider the following recommendations:

1. **Avoid Adding Manure:** Manure, while rich in nutrients, often contains high levels of phosphorus. Limit its addition to reduce phosphorus levels.

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127.0.0.1:5000/PesticideRecommendation.html

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HOME CROP FERTILIZER PESTICIDE

Recommended pesticide based on pest

Please upload the picture which clearly shows the pest, so that we can recommend you, the pesticide accordingly!

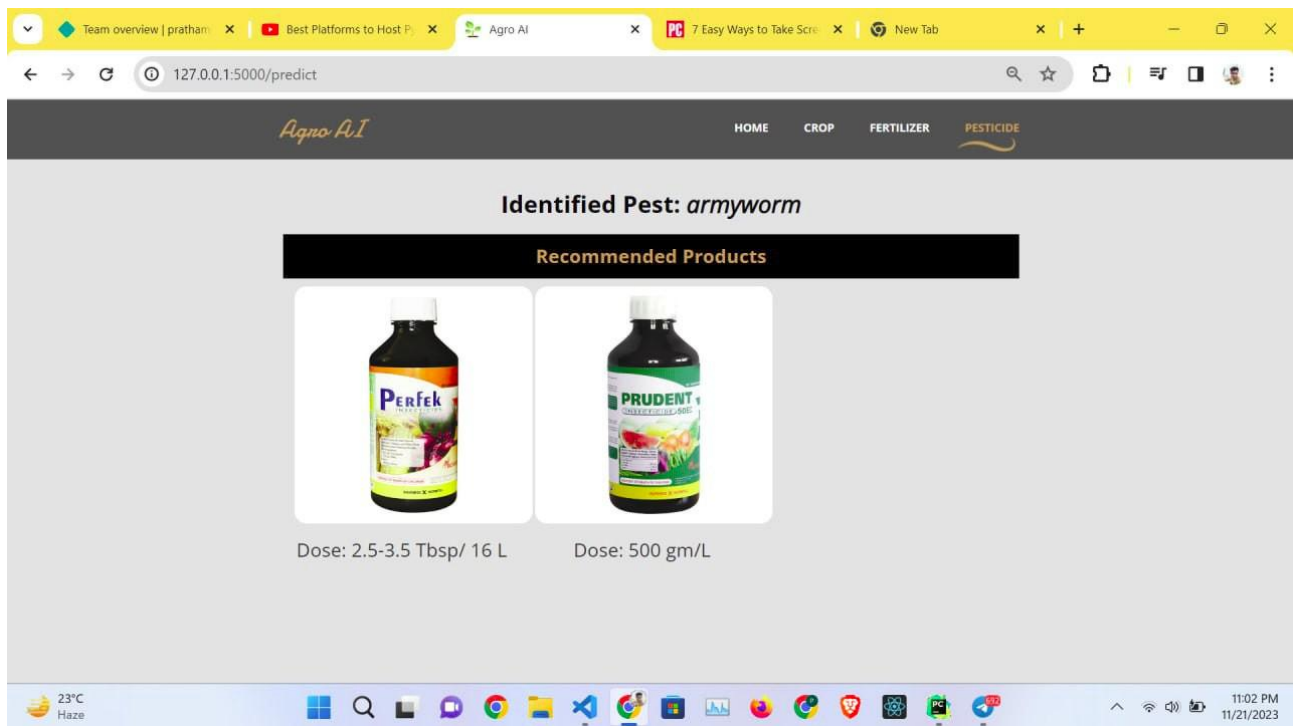
Choose File

jpg_9.jpg

Predict

23°C Haze

11:02 PM 11/21/2023



Usage of AI in Agro AI :-

In this project, AI plays a crucial role in providing intelligent solutions to agricultural challenges.

1. Crop Recommendation:

- AI, specifically reinforcement learning (RL), is employed to analyze and learn from historical data related to crops, soil characteristics, and environmental factors.

2. Fertilizer Recommendation:

- The project employs AI for recommending organic fertilizers based on user-input values for N, P, K, and the selected crop.
- By calculating the difference between desired and actual nutrient levels, the system categorizes the nutrient status as high, low, or optimal, using this information to suggest suitable organic fertilizers.

3. Pesticide Recommendation:

- Deep learning (DL), specifically Convolutional Neural Networks (CNN), is utilized for pest identification from uploaded images.
- The DL model is trained on a dataset created by scraping images from Google and augmented to increase variability.
- The system recommends pesticides based on the identified pests, adhering to ISO standards

4. Precision Agriculture:

- The concept of precision agriculture involves leveraging AI to analyze and interpret data from various sources, guiding farmers in making informed decisions.
- Site-specific parameters are considered to provide personalized recommendations, optimizing the use of resources and maximizing productivity.

5. Irrigation Controller:

- It is a AI model that is made using q table (q learning) and Reinforcement learning

Summary

The Agro AI project is a comprehensive initiative leveraging artificial intelligence (AI) to address key challenges in Indian agriculture. With a focus on sustainable farming, the project utilizes Reinforcement Learning and deep learning (DL) techniques to provide real-time recommendations for crop selection, fertilizer usage, and pest control. The Crop Recommendation module employs an ensemble model to analyze site-specific parameters, guiding farmers in choosing the most suitable crops. The Fertilizer Recommendation feature uses AI to suggest organic fertilizers based on nutrient levels and crop type. Additionally, the Pesticide Recommendation module utilizes DL, specifically Convolutional Neural Networks (CNN), for pest identification and recommends corresponding pesticides adhering to ISO standards.

REFERENCES

- <https://www.kaggle.com/datasets/simranvolunesia/pest-dataset>
- <https://www.irjet.net/archives/V5/i11/IRJET-V5I1190.pdf>
- https://plantmethods.biomedcentral.com/articles/10.1186/s13007-019-0475-z?utm_source=dlvr.it&utm_medium=twitter
- <https://github.com/simranvolunesia>