FARM AI - AI ASSISTED APP FOR FARMERS

A PROJECT REPORT

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BONAFIDE CERTIFICATE

Certified that this Thesis titled **“FARM AI - AI ASSISTED APP FOR FARMERS**” is the bonafide work of “**RAGAVENDAR K (2116210701202), RAGHAV V (2116210701203), ROHIT M (2116210701215)”** who carried out the work under my supervision. Certified further that to the best of my knowledge the work reported herein does not form part of any other thesis or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate.

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ABSTRACT

An inventive web program called FarmAI Companion is using artificial intelligence to transform farming methods. With an emphasis on helping farmers make knowledgeable choices, the app provides tailored suggestions for resource management, agribusiness practices, and crop selection.Using climatic data, past crop performance, and local soil characteristics, the program uses machine learning algorithms to provide farmers recommendations for crops that do well in their particular settings. Adherence to ideal planting schedules is ensured by a dynamic planting calendar, and weather-informed decision-making is facilitated by real-time weather integration.FarmAI Companion provides intelligent irrigation suggestions based on soil moisture levels and weather forecasts, going beyond crop selection. Customized fertilization schedules optimize nutrient management for greater effectiveness and less environmental impact.Using picture recognition, the app also manages pests and diseases, giving farmers access to immediate detection and suggested preventative actions.

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TABLE OF CONTENTS

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

New technologies are driving a transition in the agriculture sector, which appears highly promising as it will allow this main sector to advance to the next level of farm profitability and production [1]. Precision farming involves using inputs (what is required) when and where needed, has emerged as the third wave of the modern agricultural revolution (the first waves being mechanization and the second being the green revolution with genetic modification [2]). These days, thanks to the availability of more data, it is being improved with an expansion of farm knowledge systems.

Precision agriculture technologies enhanced net returns and operating profits, as the US Department of Agriculture (USDA) already announced in October 2016 [3]. In addition, farms are rapidly implementing innovative technologies when it comes to the environment to continue farming's sustainable production. Adoption of these technologies does, however, come with risk and trade-offs. A market analysis indicates that improved farmer education and training, knowledge exchange, simple access to funding, and rising consumer demand for organic food are the things that would make it easier for sustainable farming methods to be adopted [4].

Using these new technologies to extract data from crops presents a difficulty because the data are merely numbers or photos and cannot be used in and of itself. Instead, the data must be coherent and worthwhile. Farms that choose to use technology in some capacity have several benefits, including labor and cost savings, greater productivity with less effort, and the production of high-quality food using more ecologically friendly methods [5].

The final purpose of this paper is to demonstrate how making decisions with the modern data-based agriculture available today can lead to sustainable and profitable actuation to nourish people while reducing harm to the environment. In order to evaluate how modern agriculture can help in a sustainable decision-making process, this article revisits the main steps of an information-based agriculture and focuses on data management systems by reviewing recent applications related to each crucial step, from data acquisition in crop fields to the execution of tasks with variable rate equipment.

1.1 PROBLEM STATEMENT

The FarmAI Companion project addresses the challenges faced by farmers in traditional agriculture, where obstacles such as suboptimal crop selection, inefficient resource utilization, and limited access to real-time information hinder productivity and sustainability. These challenges, compounded by climate change impacts and the absence of centralized support systems, highlight the need for innovative solutions.

By leveraging artificial intelligence and data analytics, FarmAI Companion aims to provide personalized recommendations, precision farming practices, and community support through a mobile application. Through this, the project seeks to empower farmers with actionable insights, improve crop yields, and foster sustainable agricultural practices, thereby addressing critical gaps in the agricultural landscape.

1.2 SCOPE OF THE WORK

The goal of the FarmAI Companion project is to transform agricultural practices through the creation and deployment of a feature-rich mobile application. The development of AI-driven algorithms for targeted crop selection, precision farming methods, and pest control are important elements included in the scope. In order to give farmers useful information and suggestions, the program will incorporate picture recognition technology, soil health evaluations, and real-time weather data. The initiative also include creating a community platform that fosters cooperation and knowledge exchange among farmers. The scope also includes user-friendly progress monitoring capabilities, content localization in regional languages, and marketplace integration for agricultural inputs.The initiative intends to address issues with conventional agriculture, advance sustainability, and provide farmers with easily available, AI-assisted solutions for better production and informed decision-making.

1.3.AIM AND OBJECTIVES OF THE PROJECT

With the use of artificial intelligence and data analytics, the FarmAI Companion project seeks to transform traditional agriculture by providing farmers with individualized insights, advice, and support. The project aims to promote sustainable farming methods, increase production, and address major difficulties encountered by farmers through the development of a comprehensive mobile application.

Create a crop suggestion engine powered by AI that can offer customized advice based on climate data, soil characteristics in the area, and past crop performance.Use smart fertilization and irrigation strategies as well as precision farming techniques to maximize resource efficiency and minimize environmental impact.Provide farmers with the ability to make educated judgments and take preventative actions for irrigation and pest management

1.4 RESOURCES

This project has been developed through widespread secondary research of accredited manuscripts, standard papers, business journals, white papers, analysts information, and conference reviews. Significant resources are required to achieve an efficacious completion of this project.

The following prospectus details a list of resources that will play a primary role in the successful execution of our project:

- A properly functioning workstation (PC, laptop, net-books etc.) to carry out desired research and collect relevant content.
- Unlimited internet access.
- Unrestricted access to the university lab in order to gather a variety of literature including academic resources (for e.g. Prolog tutorials, online programming examples, bulletins, publications, e-books, journals etc.), technical manuscripts, etc. Prolog development kit in order to program the desired system and other related software that will be required to perform our research.

1.5 MOTIVATION

The FarmAI Companion project is driven by a deep-seated desire to tackle the opportunities and problems that the agriculture industry faces. With the use of cutting-edge technology like artificial intelligence and data analytics, the initiative seeks to equip farmers with the know-how, resources, and assistance they require to prosper in a changing and complicated agricultural environment. The project team is driven by the opportunity to transform conventional farming methods, increase productivity, and advance sustainability, all of which might have a significant impact on the lives of farmers, communities, and the environment. Furthermore, the project's efforts have the potential to cultivate a cooperative and encouraging farming community, which motivates the team to seek out novel ideas that can bring about long-lasting improvements in the agricultural sectors.

CHAPTER 2
LITERATURE SURVEY

The efficiency and accuracy of numerous prediction models have been improved by recent advances in agricultural and environmental monitoring. These innovations have made substantial use of a variety of machine learning and deep learning algorithms in conjunction with IoT and other contemporary technologies. These developments have a wide range of uses, such as solar system optimization, water conservation, soil moisture prediction, evapotranspiration, and drought prediction. In this section, we explore the contributions made by different researchers in these fields, looking at the technologies and methods they used as well as the performance results they were able to get.

Choudhary et al. [1] employed Partial Least Square Regression (PLSR) to develop an evapotranspiration model using inputs such as climatic conditions and soil moisture content. By integrating economic hardware and sensors through the Internet of Things (IoT), this approach resulted in increased efficiency and economic feasibility.

Anand et al. [2] explored the use of a Fuzzy Logic Controller within the Penman–Monteith model, focusing on inputs like temperature and soil humidity. By incorporating wireless sensor networks, comprising sensor nodes, hubs, and control units, the system achieved automated drip irrigation and water conservation. Fuzzy logic is particularly suited for managing uncertainty and imprecision, making it ideal for agricultural applications where environmental conditions can be highly variable.

Subathra et al. [3] utilized an Artificial Neural Network (ANN) method for soil moisture prediction, taking into account climatic conditions, soil moisture content, and topography. The ANN model demonstrated high precision and robustness, contributing to significant water savings. ANNs are known for their ability to model complex, nonlinear relationships, making them suitable for environmental modeling where multiple interdependent factors influence outcomes.

Chen et al. [4] harnessed a convolutional neural network (CNN) to analyze soil water content and meteorological data, using deep learning and near-infrared (NIR) spectroscopy to achieve a 93% prediction accuracy. CNNs are powerful tools for image and pattern recognition, which can be extended to spectral data analysis.

Arvind et al. [5] implemented a machine learning algorithm utilizing inputs such as moisture levels, weather forecasts, and water levels. By integrating IoT, ZigBee technology, and an Arduino microcontroller, the system effectively predicted drought conditions.

Poblete et al. [6] combined meteorological data and soil composition with ANN and other machine learning techniques to develop an evapotranspiration model using unmanned aerial vehicles (UAV) and remote sensing platforms.

Melit and Benghanem [7] utilized ANN networks for optimal model sizing within hybrid intelligent systems (HIS) designed for standalone photovoltaic systems. This approach addresses the challenge of accurately sizing photovoltaic systems to meet energy demands while considering variable environmental conditions.

Richards and Cnibeer [8] employed regression comparison for optimal model sizing in standalone power supply systems, focusing on seasonal variability of solar insolation.

Hernandez and Medina [9] applied genetic algorithms for optimal model sizing in grid-connected PV systems, aiming to maintain stability in voltage distribution.

Ammmar and Oualha [10] employed Feed Forward Neural Networks and Adaptive Neuro Fuzzy Inference Systems (ANFIS) for photovoltaic power forecasting within solar pumping systems. These methods enhance the accuracy of power forecasts, which is essential for efficient solar pump operation and water resource management.

Lastly, Chandel et al. [11] utilized deep learning models like AlexNet, GoogLeNet, and Inception V3 with crop data and images for water stress modeling, achieving remarkable accuracy with GoogLeNet. Deep learning models, particularly convolutional neural networks, are well-suited for image analysis tasks, allowing for precise identification of water stress indicators in crops.

CHAPTER 3

SYSTEM DESIGN

3.1 GENERAL

In this section, we would like to show how the general outline of how all the components end up working when organized and arranged together. It is further represented in the form of a flow chart below.

3.2 SYSTEM ARCHITECTURE DIAGRAM

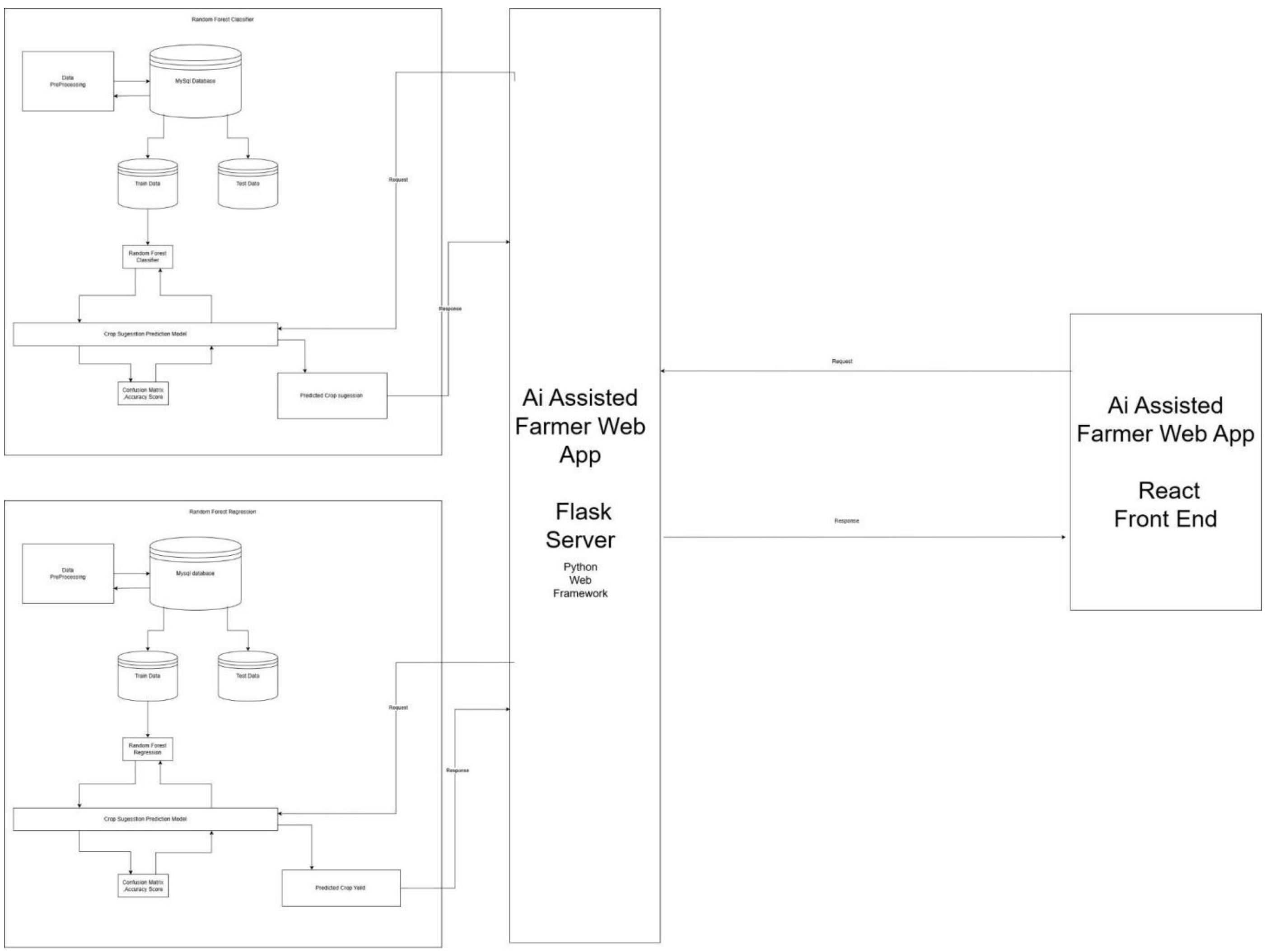

Fig 3.1: System Architecture

The system architecture of FarmAI Companion integrates multiple data sources and technologies to deliver intelligent agricultural solutions to farmers,as depicted in Fig.3.1. The system begins by collecting real-time and forecasted weather data from the OpenAI Weather API, along with soil, land, geo-spatial, and crop performance data. This data is integrated and stored in a MongoDB database for efficient processing. Using Python, the system performs data analysis and machine learning on the stored data to train predictive models, which generate actionable insights and recommendations for farmers, such as optimal crop selection, irrigation schedules, and pest control measures. A server manages these models and handles requests from the user interface, processing them and sending responses back to the UI. The user interface, built with HTML for structure, CSS for styling, and JavaScript for interactivity, allows farmers to submit requests and receive tailored solutions. This architecture ensures a seamless flow of data and insights, leveraging advanced technology to enhance agricultural productivity and sustainability.

3.3 DEVELOPMENTAL ENVIRONMENT

3.3.1 HARDWARE REQUIREMENTS

The hardware requirements may serve as the basis for a contract for the system's implementation. It should therefore be a complete and consistent specification of the entire system. It is generally used by software engineers as the starting point for the system design.

Table 3.1 Hardware Requirements

COMPONENTS	SPECIFICATION
PROCESSOR	Intel Core i5
RAM	8 GB RAM
GPU	NVIDIA GeForce GTX 1650
MONITOR	15" COLOR
HARD DISK	512 GB
PROCESSOR SPEED	MINIMUM 1.1 GHz

3.3.2 SOFTWARE REQUIREMENTS

The software requirements document is the specifications of the system. It should include both a definition and a specification of requirements. It is a set of what the system should rather be doing than focus on how it should be done. The software requirements provide a basis for creating the software requirements specification. It is useful in estimating the cost, planning team activities, performing tasks, tracking the team, and tracking the team's progress throughout the development activity.

Python IDLE, and **chrome** would all be required.

CHAPTER 4

PROJECT DESCRIPTION

4.1 METHODOLOGY

In conventional farming, farmers frequently encounter difficulties with crop selection optimization, precision farming implementation, and obtaining tailored agri-input recommendations. Inadequate evaluation of soil health, a lack of up-to-date weather information, and difficulty in obtaining professional guidance all lead to less-than-ideal agricultural methods, which diminish crop yields and waste resources.

In order to solve these problems, the present agricultural environment necessitates a holistic approach that makes use of cutting-edge technology like artificial intelligence and data analytics. Overcoming current obstacles and promoting sustainable, knowledgeable, and resilient agricultural methods require a mobile application that offers tailored crop suggestions, insights into precision farming, real-time weather data, and a helpful community platform. By providing farmers with easily available, useful, and AI-assisted agricultural insights, the FarmAI Companion project seeks to close these gaps and transform the agricultural industry.

The goal of the suggested system, FarmAI Companion, is to transform agriculture by utilizing cutting-edge technology to overcome the shortcomings of the current setup. Putting into practice a strong AI-driven crop recommendation engine that examines regional soil characteristics, climatic information, and past crop performance. Based on their unique geographic location, this tool offers farmers individualized advice for the best crop choices. providing accurate suggestions for intelligent fertilization and irrigation using AI algorithms.In order to maximize resource use and encourage sustainable farming methods, the system takes into account real-time data on crop nutrient requirements, soil moisture levels, and weather forecasts.Create a live Q&A feature in the app to let farmers engage with peers and agricultural professionals. This creates a feeling of community and facilitates the exchange of knowledge, giving farmers access to a cooperative learning environment and support system.

4.2 MODULE DESCRIPTION

Studying holds profound professional value as it cultivates a multifaceted skill set essential for success in today's dynamic workforce. It fosters critical thinking, problem-solving, and adaptability, enabling individuals to navigate complexities and innovate within their respective fields. Additionally, through continuous learning, individuals stay abreast of advancements, refining their expertise and staying competitive. Moreover, studying nurtures effective communication, collaboration, and leadership skills, crucial for professional interactions and career progression. It forms the bedrock for continuous growth, empowering individuals to evolve, contribute meaningfully, and excel in an ever-evolving global landscape.

In our project,we have integrated the following modules:

4.2.1. AI-Driven Crop Recommendations

4.2.2. Dynamic Planting Calendar

4.2.3. Real-Time Weather Integration

4.2.4. Pest and Disease Identification with Image Recognition

4.2.5. User Progress Tracking and Analytics

4.2.1. AI-Driven Crop Recommendations:

Advanced machine learning techniques are used by FarmAI Companion's AI-Driven Crop Recommendations module to evaluate a variety of data inputs, including local soil conditions, climatic data, and past crop performance. With the integration of soil sensor, weather station, and agricultural database data, the system offers customized crop selection recommendations based on each farmer's unique geographic location. This guarantees that farmers get suggestions for crops that have the best chance of thriving in their particular environmental conditions, supported by science, hence increasing agricultural efficiency and production potential.

4.2.2. Dynamic Planting Calendar:

The Dynamic Planting Calendar module gives farmers advice on when to sow, transplant, and harvest their crops using an interactive and adaptable calendar. This application generates a customized planting schedule based on historical agriculture data, seasonal weather fluctuations, and local climatic trends. This module helps farmers avoid possible problems associated with incorrect planting seasons and optimize crop yields by coordinating agricultural activities with optimal timing. The calendar's dynamic structure guarantees that it will adjust to shifting circumstances and offer current recommendations all through the growing season.

4.2.3. Real-Time Weather Integration:

Farmers may now make proactive and well-informed decisions by having immediate access to vital weather information thanks to the Real-Time Weather Integration module. Farmers may better prepare for and respond to weather-related difficulties including rainfall, temperature variations, and extreme weather occurrences by using the system, which incorporates present and anticipated meteorological data. This function is very helpful for scheduling pest control treatments, controlling irrigation schedules, and shielding crops from unfavorable weather. Farmers are able to protect their crops in a timely manner by being informed of impending changes through real-time weather notifications.

4.2.4. Pest and Disease Identification with Image Recognition:

Using picture recognition technology, the Pest and Disease Identification module helps farmers identify problems with their crops. Through the app, farmers may upload pictures of impacted plants, which the computer will then examine to determine whether they are pests or illnesses. The system offers comprehensive information about the issue and suggested remedial actions upon identification. With the use of this quick diagnostic tool, farmers may minimize crop damage, cut losses, and preserve good crops with minimal delay. The module also aids in knowledge development by listing typical problems and workarounds.

4.2.5. User Progress Tracking and Analytics:

Farmers may track and evaluate their farming operations over time with the help of the User Progress Tracking and Analytics module. Farmers may monitor a range of data with this function, which is easy to use: input utilization, crop performance, and productivity trends. The technology assists farmers in identifying areas for development and making data-driven decisions by providing this data in a readily understood format. Continuous farming practice optimization and improvement are made possible by the analytics component, which provides insights and recommendations based on past performance. Farmers are equipped with the knowledge in this subject to increase productivity and provide better outcomes.

CHAPTER 5

RESULTS AND DISCUSSIONS

5.1 OUTPUT

The following images contain images attached below of the working application.

User Interface by which farmer should enter the needed particulars to predict the crop yield,farming practices

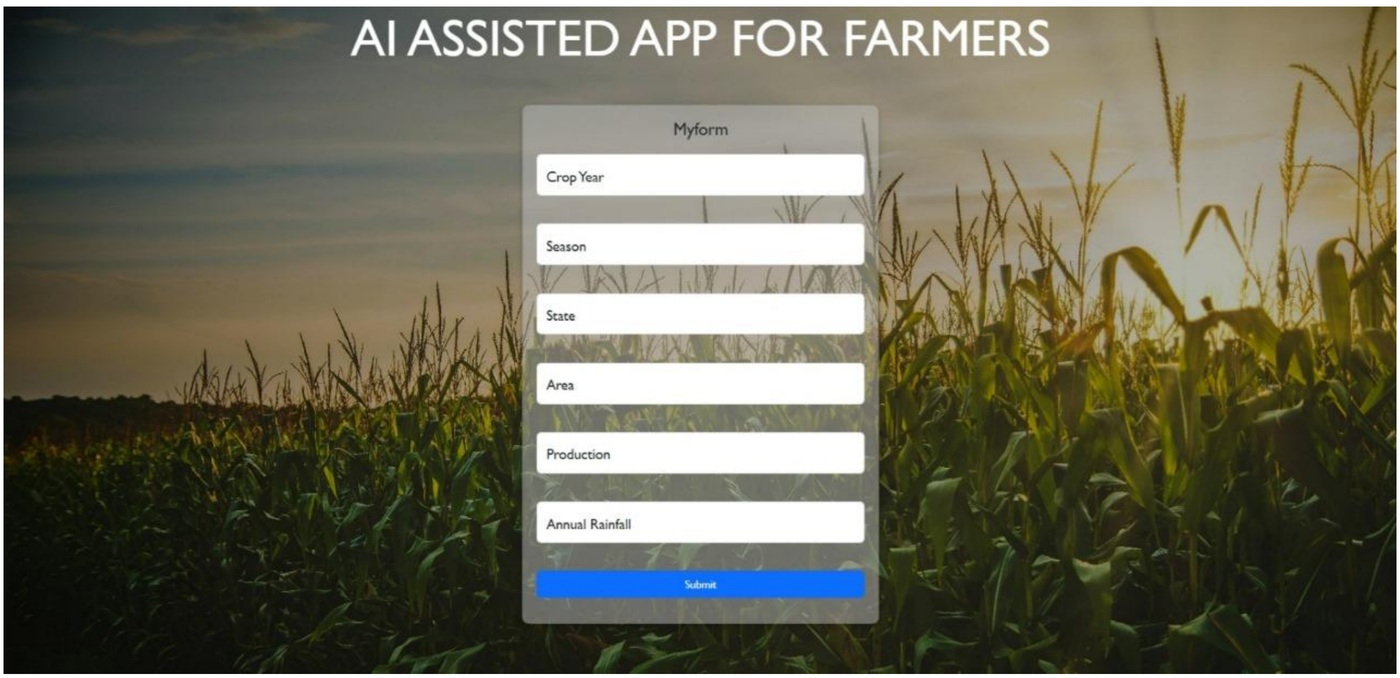

Fig 5.1: UI Output

The farmer has to enter the form particulars such as crop year, season, state, area. production, annual rainfall . The data in the form is sent to the backend.

Output generation by our ML model :

Fig 5.2:ML MODEL OUTPUT

The model will make an analysis and give the output .And this output is very helpful for the farmer to make decision in the upcoming season.

5.2 RESULT

The goal of the FarmAI Companion project is to transform agriculture by providing farmers with AI-driven solutions that meet their needs. Through the use of cutting-edge technology, the initiative aims to provide farmers with assistance and actionable information while addressing major issues in the current agricultural scene.

Anticipated Results:

1. Increased Crop Yields: Precision farming techniques and tailored advice will increase crop yields.
2. Improved Resource Efficiency: By optimizing resources like fertilizers and water, environmental effect will be decreased.
3. Enhanced climatic Resilience: Farmers will be able to adjust to shifting climatic patterns with the use of real-time weather integration.
4. Emergency Pest and Disease Management: Prompt identification and mitigation strategies will reduce agricultural losses.
5. Empowered Farming Community: Cooperation and ongoing learning will be encouraged by having access to peer assistance and professional guidance.

Through the promotion of sustainable and knowledgeable farming methods, the FarmAI Companion project seeks to support the agricultural sector's long-term prosperity and progress.

CHAPTER 6

CONCLUSION AND FUTURE ENHANCEMENT

6.1 CONCLUSION

In summary, the FarmAI Companion project offers farmers a complete and technologically advanced solution to meet the issues they confront, marking a significant advancement in the evolution of agriculture. Through the application of artificial intelligence, real-time data analytics, and community engagement, the initiative seeks to improve productivity, empower farmers with tailored insights, and advance sustainable farming methods.

By utilizing precision farming methods, proactive pest and disease control, and optimum crop selection, the initiative has the potential to boost resistance to climate-related issues, enhance resource efficiency, and enhance agricultural yields. Furthermore, the creation of an encouraging community platform encourages farmers to work together and share expertise, which promotes a culture of ongoing learning and development.

All things considered, the FarmAI Companion project has the potential to transform agriculture and benefit farmers, communities, and the environment. A more resilient, effective, and sustainable agriculture sector is being paved by the initiative by giving farmers the resources and tools they need to prosper in a world that is changing quickly.

FUTURE ENHANCEMENT

In order to better serve farmers' changing demands, FarmAI Companion project improvements in the future may concentrate on utilizing cutting-edge technology even further and broadening the range of capabilities. Here are a few such areas that might be improved:

More Complex AI Algorithms: For even more precise recommendations, keep enhancing and refining the AI-driven crop suggestion engine by adding more sophisticated data sources, such satellite images and crop genetics.
Using Machine Learning to Predict Diseases: Using machine learning algorithms, create prediction models to forecast disease outbreaks based on historical data, environmental conditions, and crop health indicators. This will allow for proactive management practices.

Integration of Internet of Things (IoT) Devices: Use IoT devices for real-time data collecting and monitoring, such as drones, weather stations, and soil moisture sensors. This will give farmers precise decision-making insights.

Utilize blockchain technology to improve supply chain traceability and transparency in the agriculture industry. This will allow farmers to monitor the provenance and caliber of agricultural inputs and finished goods.

Using Augmented Reality (AR) for Support and Training: Utilize augmented reality (AR) technology to give farmers immersive learning experiences and on-the-spot coaching through interactive training modules and virtual help for farm management activities.

Enhanced Language Support and Localization: Provide access for farmers in a variety of linguistic communities by expanding language support to include more regional languages and dialects and customizing material for certain cultural contexts.

Collaborative Research and Development (R&D): Establish alliances with academic institutions and agricultural associations to carry out R&D projects together. By pooling resources, you may solve urgent problems and stimulate creativity

APPENDIX

SOURCE CODE:

api.py

```
from flask import Flask, request, jsonify
from flask_cors import CORS
from recommend import crop_recommend,crop_yeild
from icecream import ic
app = Flask(__name__)
CORS(app)

@app.route('/api/recommend', methods=['POST'])
def handle_form_data():
    data = request.json
    cropS=crop_recommend(data)
    cropY=crop_yeild(data,cropS)
    response=cropY|{"Crop":cropS}|data
    return jsonify(response)

if __name__ == '__main__':
    app.run(debug=True,host='0.0.0.0',port=5000)
```

recommend.py

```
import json
import pickle
import pandas as pd
from sklearn.preprocessing import LabelEncoder
from icecream import ic
label_encoder = LabelEncoder()
load_model_R=pickle.load(open('Crop_Recommend.pkl','rb'))
load_model_Y=pickle.load(open('Crop_Yeild_Predict.pkl','rb'))

def crop_yeild(request,cropS):
    ip={"Crop":cropS}|request
    input_df = pd.DataFrame([ip])
    input_df['Season']=label_encoder.fit_transform(input_df['Season'])
    input_df['State']=label_encoder.fit_transform(input_df['State'])
    input_df['Crop']=label_encoder.fit_transform(input_df['Crop'])
    y_pred = load_model_Y.predict(input_df)

y_pred=pd.DataFrame(y_pred,columns=['Fertilizer','Pesticide','Yield']).to_json(orient='
records')
    y_pred=json.loads(y_pred)[0]
    return y_pred
```

```
def crop_recommend(request):

   input_df = pd.DataFrame([request])
   ic(input_df)
   input_df['Season']=label_encoder.fit_transform(input_df['Season'])
   input_df['State']=label_encoder.fit_transform(input_df['State'])
   y_pred = load_model_R.predict(input_df)

   return y_pred[0]

a=crop_yeild({
    "Crop_Year": 2024,
    "Season": "Kharif",
    "State": "Tamil Nadu",
    "Area": 95217.0,
    "Production": 35885,
    "Annual_Rainfall":315.9,
    },"Urad")

print(a)
#output {'Fertilizer': 12.1582367994, 'Pesticide': 16339137.180100005, 'Yield': 34844.3036}
```

Front End Code:

Index.html

```html
 <!doctype html>
<html lang="en">
<head>
  <meta charset="UTF-8" />
  <link rel="icon" type="image/svg+xml" href="/vite.svg" />
  <meta name="viewport" content="width=device-width, initial-scale=1.0" />
  <script src="https://cdn.jsdelivr.net/npm/react/umd/react.production.min.js"
crossorigin></script>
  <script src="https://cdn.jsdelivr.net/npm/react-dom/umd/react-dom.production.min.js"
crossorigin></script>
  <script src="https://cdn.jsdelivr.net/npm/react-bootstrap@next/dist/react-bootstrap.min.js"
crossorigin></script>
  <script>var Alert = ReactBootstrap.Alert;</script>
  <link rel="stylesheet"
href="https://cdn.jsdelivr.net/npm/bootstrap@5.3.2/dist/css/bootstrap.min.css"
    integrity="sha384-
T3c6CoIi6uLrA9TneNEoa7RxnatzjcDSCmG1MXxSR1GAsXEV/Dwwykc2MPK8M2HN"
crossorigin="anonymous" />
  <title>Vite + React</title>
</head>
<body>
  <div id="root"></div>
  <script type="module" src="/src/main.jsx"></script>
</body>

</html>
```

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