FARM FRIEND – A SUGGESTIVE APPLICATION FOR FARMERS

A PROJECT REPORT

Submitted by

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BONAFIDE CERTIFICATE

Certified that this Thesis titled **"FARM FRIEND – A SUGGESTIVE APPLICATION FOR FARMERS**" is the bonafide work of "**MANNURU SHREEYA (2116210701148), MERCY N (2116210701157), NAVNEETH SURESH (2116210701176)"** who carried out the work under my supervision. Certified furtherthat 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 onan earlier occasion on this or any other candidate.

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ABSTRACT

This project endeavors to develop an integrated mobile and web-based application fueled by advanced AI algorithms and data analytics to revolutionize agricultural practices and bolster crop productivity. The application boasts a user-friendly interface accommodating multiple languages and incorporates a responsive chatbot for seamless interaction. Core functionalities encompass precise weather forecasting, sophisticated soil analysis via image processing, tailored crop recommendations, irrigation optimization strategies, and eco-friendly solutions for natural fertilizers and pest control. Leveraging GPS technology, the app delivers location-specific insights, while stringent security protocols ensure the protection of user data. Motivated by the imperative to empower farmers with cutting-edge technology, this initiative aims to foster sustainable agricultural practices and enhance the resilience of farming communities worldwide. Through this project, we aspire to contribute significantly to the advancement of global food security and environmental sustainability.

ACKNOWLEDGMENT

First, we thank the almighty god for the successful completion of the project. Our sincere thanks to our chairman **Mr. S. Meganathan B.E., F.I.E.,** for his sincere endeavor in educating us in his premier institution. We would like to express our deep gratitude to our beloved Chairperson **Dr. Thangam Meganathan Ph.D.,** for her enthusiastic motivation which inspired us a lot in completing this project and Vice Chairman **Mr. Abhay Shankar Meganathan B.E., M.S.,** for providing us with the requisite infrastructure.

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CHAPTER 1
INTRODUCTION

In today's dynamic agricultural landscape, harnessing the power of technology is essential for sustainable and efficient farming practices. Recognizing this need, we present a comprehensive solution in the form of a mobile and web-based application tailored specifically for farmers. Our AI-assisted app combines advanced data analytics with intuitive features to revolutionize agricultural practices and maximize crop yields.

At its core, our app serves as a virtual agricultural advisor, leveraging cutting-edge AI algorithms to provide personalized farming recommendations. From suggesting optimal crops based on soil type and weather conditions to offering insights into soil fertility and irrigation methods, our platform equips farmers with the knowledge and tools needed to make informed decisions.

One of the key features of our app is its multi-language support, ensuring accessibility to farmers from diverse linguistic backgrounds. Furthermore, our user-friendly interface includes a chatbot interface for seamless interaction, allowing farmers to seek instant guidance and assistance at their convenience.

With features like weather forecasting, soil analysis through image processing, and DIY natural fertilizers and pesticides recommendations, our app empowers farmers to enhance productivity while minimizing environmental impact. By integrating location tracking and notifications, we ensure real-time updates and alerts tailored to each farmer's specific needs. In essence, our AI-assisted app redefines modern agriculture, ushering in a new era of efficiency, sustainability, and prosperity for farmers worldwide.

Moreover, our app prioritizes security and convenience, offering a streamlined login process through mobile number authentication and OTP generation. Once logged in, farmers can access personalized dashboards displaying relevant information such as crop suggestions and soil fertility status, thereby enhancing user experience and engagement. With optional captcha for added security and the ability to change mobile numbers seamlessly, our app ensures a hassle-free experience for farmers, empowering them to navigate the complexities of agriculture with confidence and efficiency.

1.1 SCOPE OF THE WORK

The scope of this project is to develop a comprehensive mobile and web-based application tailored specifically for farmers, integrating advanced AI and data analytics to address the multifaceted challenges encountered in modern agriculture. The application will feature a user-friendly interface supporting multiple languages and incorporating a chatbot for instant assistance. Key functionalities include weather forecasting for cultivation, soil analysis using image processing to determine soil type and fertility, and recommendations for suitable crops based on these factors. Additionally, the app will provide insights into irrigation methods and offer suggestions for DIY natural fertilizers and pesticides to promote sustainability. Location tracking functionalities using GPS and GIS technology will be implemented to provide localized recommendations and notifications. Security measures such as mobile number authentication with OTP generation and optional captcha will ensure user privacy. User management features including seamless mobile number updates will also be integrated. Overall, the scope encompasses the comprehensive development and deployment of a feature-rich agricultural app aimed at empowering farmers with the tools and knowledge necessary to optimize their farming practices and maximize crop yields in a rapidly evolving agricultural landscape.

1.2 AIM AND OBJECTIVES OF THE PROJECT

The aim of this project is to develop a comprehensive mobile and web-based application aimed at transforming agricultural practices through the integration of advanced AI and data analytics. Our primary objective is to empower farmers globally by providing them with accessible and intuitive tools to enhance productivity, sustainability, and profitability in their farming operations.

To achieve this aim, we have outlined several key objectives. Firstly, we aim to design and implement a user-friendly interface that caters to the diverse linguistic backgrounds of farmers, ensuring ease of access and interaction. Secondly, our focus is on leveraging AI algorithms to deliver accurate weather forecasts tailored to specific cultivation requirements, enabling farmers to plan and optimize their farming activities effectively.

Another crucial objective is the implementation of image processing technology to analyze soil type and fertility, providing personalized crop recommendations based on soil characteristics. Additionally, we aim to offer insights into efficient irrigation methods and recommendations for DIY natural fertilizers and pesticides, promoting sustainable farming practices among users.

Furthermore, the project encompasses the integration of location tracking functionalities using GPS and GIS technology to deliver localized recommendations and notifications based on geographical data. Security and privacy are also paramount, with features such as mobile number authentication, OTP generation, and optional captcha ensuring user data protection.

Lastly, our objective includes developing user management functionalities, including seamless mobile number updates, to enhance user experience and convenience. By achieving these objectives, our project aims to empower farmers with the necessary tools and knowledge to optimize their farming practices, maximize crop yields, and contribute to the overall advancement and sustainability of the agricultural sector.

1.3 RESOURCES

1. Technical Expertise: A team of skilled software developers proficient in mobile and web application development, AI algorithms, data analytics, image processing, and database management.

2. Technology Stack: Utilization of appropriate programming languages, frameworks, and tools for mobile and web development, AI implementation, image processing, and database management.

3. Data Sources: Access to reliable and relevant data sources for weather forecasting, soil analysis, crop recommendations, and geographic information.

4. Hardware Infrastructure: Sufficient hardware resources for hosting and running the application, including servers, storage systems, and networking equipment.

5. Feedback Mechanism: Establishment of feedback mechanisms to gather input from users and stakeholders for continuous improvement and refinement of the application.

6. Localization Resources: Translation and localization services to support multi-language functionality, ensuring accessibility to farmers worldwide.

7. Security Measures: Implementation of robust security measures to safeguard user data and protect against cybersecurity threats.

1.4 MOTIVATION

The motivation behind this project lies in the recognition of the fundamental importance of agriculture in sustaining human life and promoting economic development. With agriculture facing numerous challenges such as climate change, soil degradation, and resource constraints, there is a pressing need to empower farmers with innovative solutions that can enhance productivity, sustainability, and resilience. By harnessing the power of AI, data analytics, and mobile technology, this project aims to provide farmers with access to timely information, personalized recommendations, and practical tools to optimize their farming practices and improve their livelihoods.

Furthermore, the project is driven by a commitment to environmental stewardship and social equity. By promoting sustainable farming practices, resource efficiency, and inclusive access to technology, the project seeks to minimize the environmental impact of agriculture and contribute to the well-being of farming communities worldwide. Ultimately, the motivation behind this project is to create positive social, economic, and environmental outcomes by empowering farmers with the knowledge, tools, and resources they need to thrive in a rapidly changing world.

CHAPTER 2
LITERATURE SURVEY

"A Survey on Agricultural Decision Support Systems: Issues and Challenges" by Majid Ghasemi-Varnamkhasti and Masoud Feizollahi (2015) provides a comprehensive examination of decision support systems in agriculture, addressing challenges and opportunities for their implementation and enhancement. The paper discusses various types of decision support systems, including expert systems, geographic information systems (GIS), and remote sensing technologies, highlighting their potential to improve decision-making processes in agriculture.

"Artificial Intelligence in Agriculture: Opportunities and Challenges" by Tanmay Mondal and Vijay Kumar Soni (2020) explores the burgeoning applications of AI in agriculture, discussing its potential to revolutionize farming practices and enhance productivity. The paper reviews AI techniques such as machine learning, computer vision, and robotics, and discusses challenges such as data availability, scalability, and ethical considerations in deploying AI solutions in agricultural settings.

"Development of a Mobile Application for Agricultural Information System" by S. Sangeetha and K. Kalaiselvi (2019) presents a mobile application designed to provide farmers with real-time agricultural information, including weather forecasts, market prices, and crop management practices. The paper discusses the development process, features, and usability of the mobile application, highlighting its potential to empower farmers with accessible and relevant information for decision-making.

"A Comprehensive Review of IoT Applications in Agriculture" by Anas Al Tarabsheh and Tariq Alwada'n (2020) offers a thorough examination of Internet of Things (IoT) applications in agriculture, encompassing areas such as precision farming, livestock management, and environmental monitoring. The paper discusses IoT technologies such as sensors, actuators, and wireless communication protocols, highlighting their potential to improve resource efficiency, crop yield, and sustainability in agricultural systems.

"Advancements in Mobile Sensing for Agriculture: A Review" by Surya Teja Kallumadi, Pravallika Vepakomma, and Bharadwaj Veeravalli (2021) explores recent advancements in mobile sensing technologies for agriculture, focusing on their applications in crop monitoring and management. The paper discusses the use of smartphones and wearable devices equipped with sensors for collecting data on soil moisture, temperature, and crop health, highlighting their potential to provide real-time insights and improve decision-making for farmers.

"Use of Artificial Intelligence in Agriculture: A Systematic Review" by Noor Al-Tamimi, Fadi Aloul, and Mustafa Alshawi (2019) conducts a systematic review of AI applications in agriculture, covering areas such as crop prediction, pest detection, and soil analysis. The paper evaluates the effectiveness and limitations of AI techniques such as machine learning, deep learning, and expert systems in addressing agricultural challenges, providing insights into future research directions and practical applications.

"Mobile Application for Weather Forecasting in Agriculture" by Shweta Singh, Manisha Dubey, and Shweta Tomar (2020) describes the development of a mobile application tailored to provide weather forecasting services for agricultural purposes. The paper discusses the design considerations, features, and usability of the mobile application, emphasizing its potential to enhance decision-making and improve productivity for farmers by providing accurate and timely weather information.

"A Review of Mobile Applications for Agriculture in Developing Countries" by Susan Wyche, Jonathan Donner, and Melissa Ho (2016) critically examines the design and impact of mobile applications for agriculture in developing countries. The paper assesses the accessibility, usability, and effectiveness of mobile applications in addressing the information needs of smallholder farmers, highlighting opportunities for improving agricultural practices and livelihoods through technology interventions.

"Recent Advances in Artificial Intelligence for Agriculture" by Rong-An Shang and Qi Zhang (2019) provides an overview of recent advancements in AI technologies for agriculture, including machine learning, robotics, and remote sensing applications. The paper discusses the potential of AI techniques to address key challenges in agriculture, such as yield prediction, disease detection, and resource optimization, and explores emerging trends and future research directions in the field.

"Mobile Apps for Agriculture and Rural Development: A Systematic Review" by Alemnew Destaw Shiferaw, Kassa Tilahun Zeleke, and Wondwosen Tamrat Zewdu (2018) conducts a systematic review of mobile applications for agriculture and rural development, examining their functionalities, usability, and impact on farmers' livelihoods. The paper evaluates the effectiveness of mobile applications in providing access to agricultural information, market linkages, and extension services, and identifies opportunities for enhancing their role in promoting sustainable agricultural practices and rural development initiatives.

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

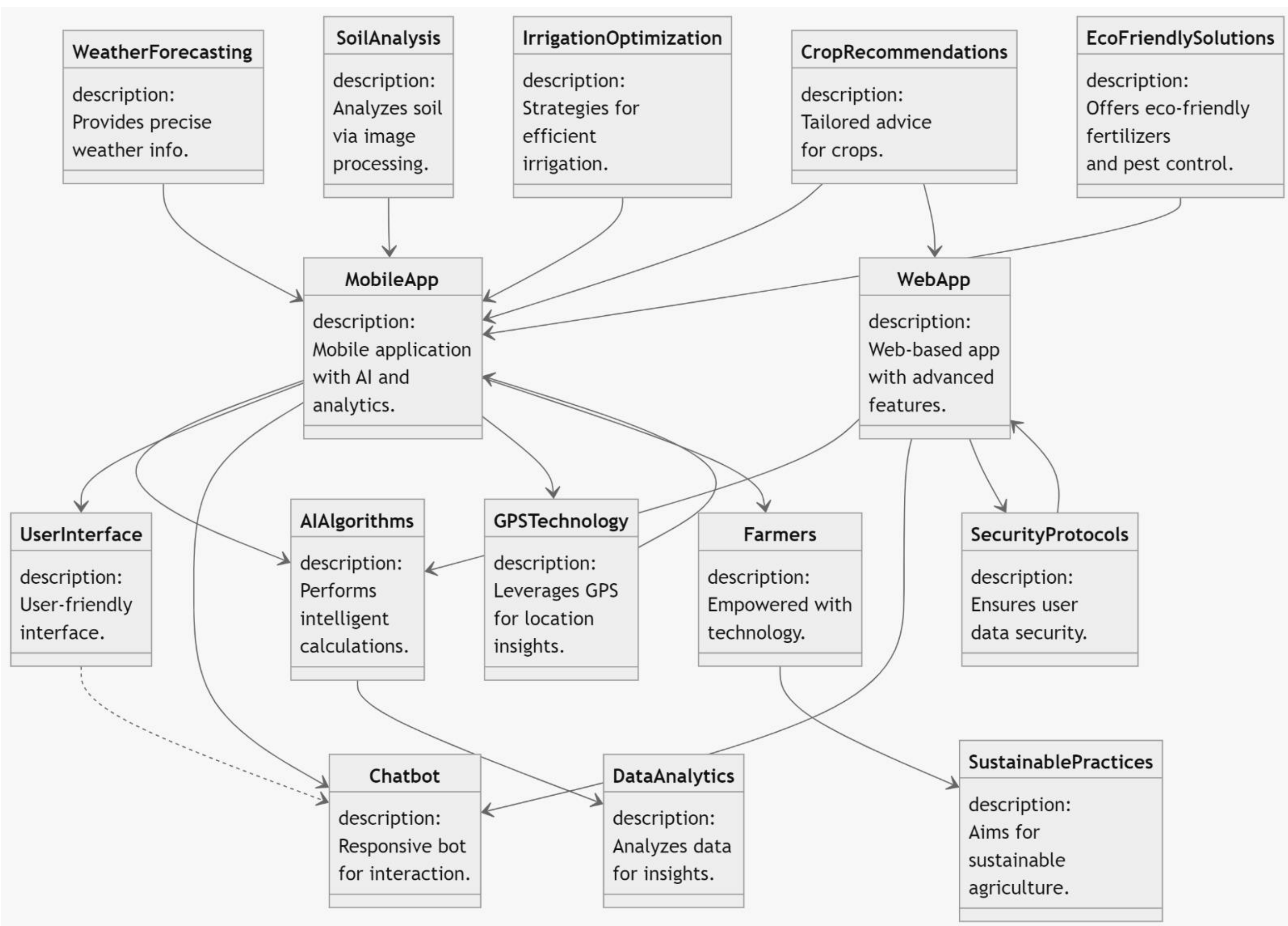


Fig 3.1: System Architecture

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 aset 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 progressthroughout the development activity.

8GB Ram, Android Studio , Flutter , 10th generation processor,
Firebase, Openweather api, Flask Framework would all be required.

CHAPTER 4
PROJECT DESCRIPTION

4.1 METHODOLODGY

The development methodology for the AI-assisted farm app encompasses a multifaceted approach aimed at leveraging advanced technologies to optimize agricultural practices and enhance productivity. Initially, diverse datasets encompassing agricultural parameters such as soil type, climate conditions, historical crop yields, and real-time weather data from the OpenWeather API are gathered and preprocessed. This data undergoes cleaning, normalization, and feature engineering to ensure consistency and quality.

Subsequently, machine learning models including logistic regression, naive Bayes, SVM, and random forest are implemented to analyze the agricultural data and provide crop suggestions tailored to specific conditions. Each model is trained using the preprocessed datasets to offer accurate recommendations, taking into account factors like soil quality, climate conditions, and real-time weather predictions.

To enhance the accuracy of the models, adaboost and gradient boosting algorithms from the Sklearn library are employed. These algorithms sequentially train weak learners to boost the performance of base models, thereby improving prediction accuracy. Additionally, Python libraries such as Seaborn, NumPy, and Pandas are utilized for accuracy calculation, model evaluation, and data visualization, ensuring thorough analysis and interpretation of results.

Incorporating additional features, the app includes OTP generation for secure user authentication, ensuring only authorized access to its functionalities. Furthermore, multi-language support is integrated to accommodate farmers from diverse linguistic backgrounds, enhancing accessibility and usability. To provide real-time assistance and valuable agricultural information, a chatbot is developed using Flutter, allowing farmers to interact naturally and seek guidance on farming practices.

Rigorous testing is conducted to validate the functionality, accuracy, and performance of the app across different devices and platforms. Once tested, the app is deployed on Flutter, ensuring compatibility with both Android and iOS devices for widespread accessibility among farmers. Through this comprehensive methodology, the AI-assisted farm app aims to empower farmers with personalized crop suggestions, real-time weather forecasts, secure authentication, multi-language support, and interactive assistance, ultimately driving efficiency and sustainability in agriculture.

4.2 MODULE DESCRIPTION

Data Gathering and Preprocessing:

The first step involves collecting diverse datasets comprising crucial agricultural information. These datasets encompass variables such as soil type, climate conditions, historical crop yields, and real-time weather data sourced from the OpenWeather API. Subsequently, the collected data undergoes rigorous preprocessing to ensure consistency and quality. This preprocessing phase includes cleaning the data to remove any inconsistencies or errors, normalization to standardize the data across different scales, and feature engineering to extract relevant features that will contribute to the effectiveness of the machine learning models.

Machine Learning Model Development:

In this phase, the focus shifts towards the implementation of various machine learning algorithms tailored to analyze the agricultural data and provide crop suggestions based on multiple parameters. The implemented algorithms include logistic regression, naive

Bayes, SVM, and random forest. Each model is trained using the preprocessed datasets to ensure accurate and personalized crop recommendations, taking into account specific conditions such as soil quality, climate characteristics, and historical crop performance.

Integration of Weather Prediction:

To further enhance the accuracy of crop suggestions, real-time weather data from the OpenWeather API is incorporated into the machine learning models. This weather data includes essential parameters such as temperature, precipitation, humidity, and wind speed. By integrating weather data into the models, the app can provide more precise recommendations based on current and forecasted weather conditions, enabling farmers to make informed decisions about crop management strategies.

Accuracy Calculation and Model Evaluation:

To ensure the reliability and effectiveness of the machine learning models, accuracy calculation and model evaluation are critical steps. Adaboost and gradient boosting algorithms from the Sklearn library are employed to boost the performance of the base models and improve prediction accuracy. Python libraries such as Seaborn, NumPy, and Pandas are utilized for accuracy calculation, model evaluation, and data visualization, allowing for comprehensive analysis and interpretation of results.

Additional Features Integration:

In this phase, additional features are integrated into the app to enhance functionality and user experience. This includes implementing OTP generation for secure user authentication, incorporating multi-language support to cater to farmers from diverse linguistic backgrounds, and developing a chatbot using Flutter to provide real-time assistance and valuable agricultural information through natural language interactions.

CHAPTER 5
RESULTS AND DISCUSSIONS

5.1 OUTPUT

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

Fig 5.1: Landing Page

Fig 5.2: Language Selection

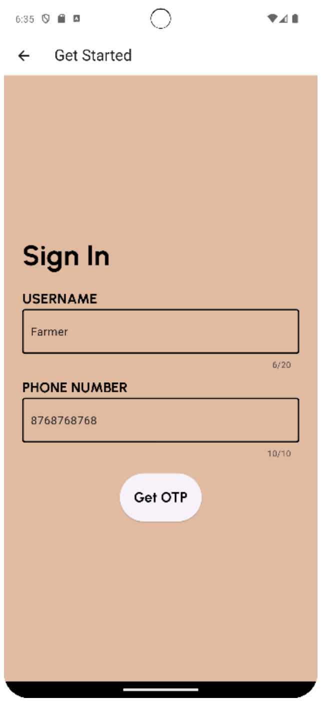


Fig 5.3: Sign in Page

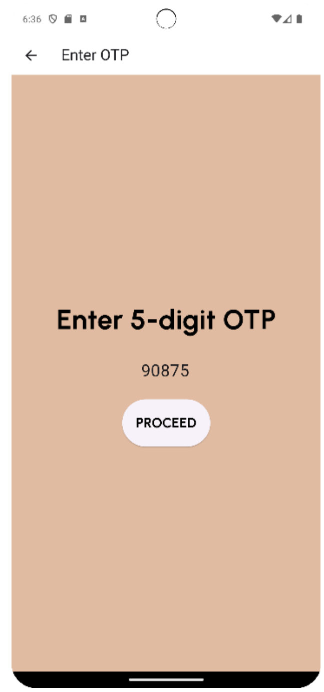


Fig 5.4: OTP Validation Page

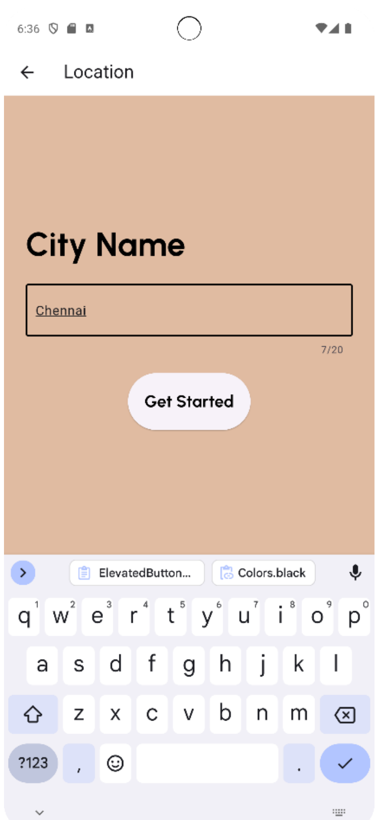


Fig 5.5: City Name for Weather Prediction

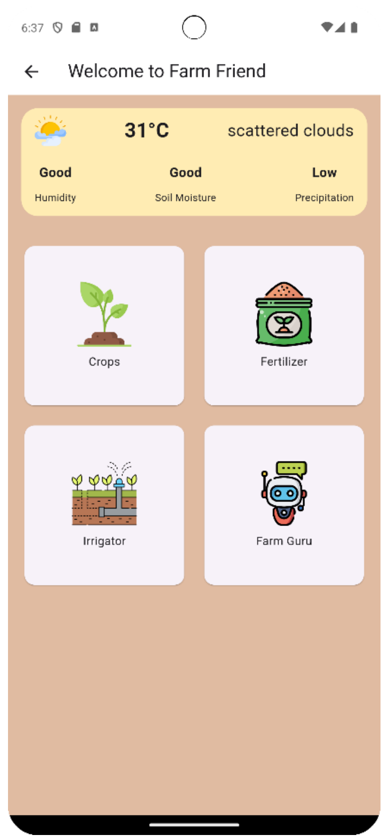
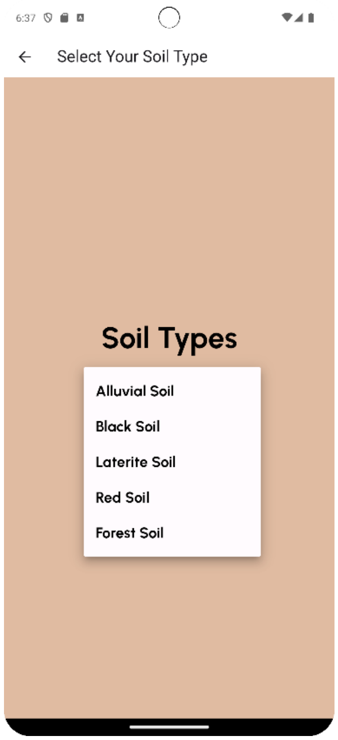


Fig 5.6: Home Page



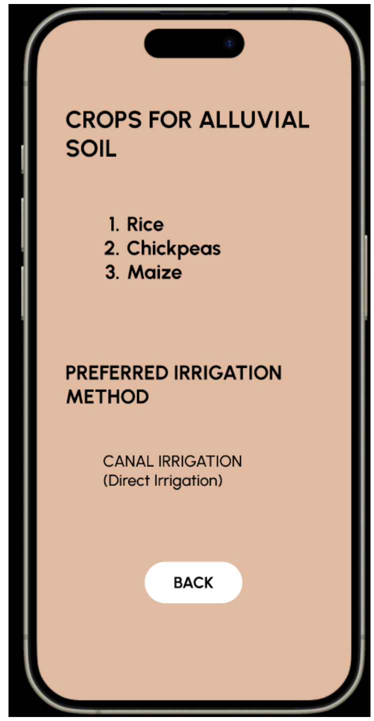
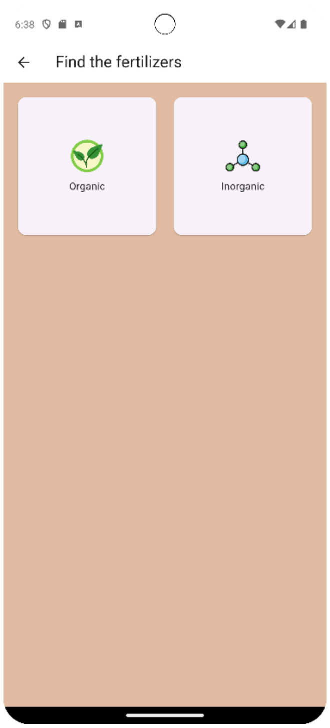


Fig 5.7: Soil Type for Crop Recommendation

Fig 5.8: Crop Recommendation based on Soil type



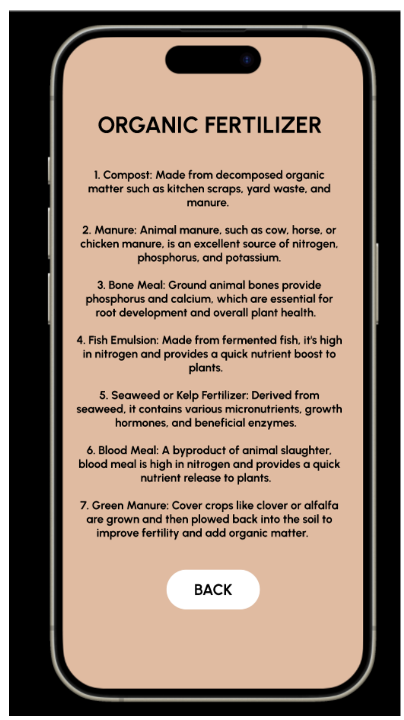


Fig 5.9: Fertilizers Blog

Fig 5.10: Organic Fertilizer Page

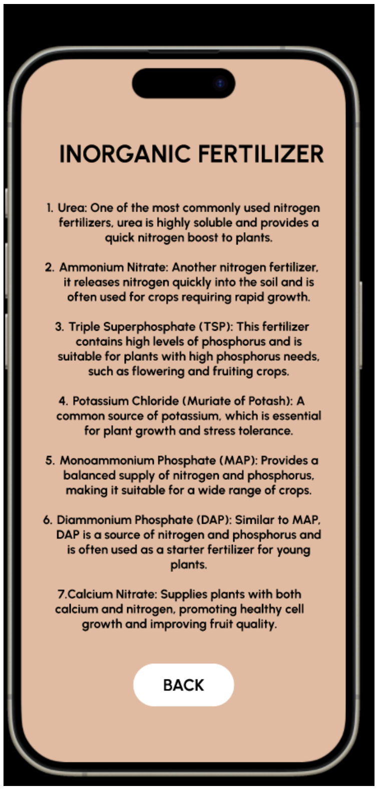


Fig 5.11: Inorganic Fertilizer Page

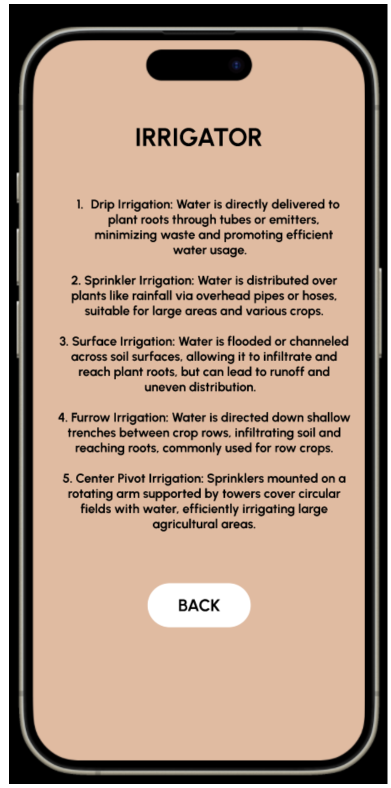


Fig 5.12: Irrigator Page

Fig 5.13: Language Selection

Fig 5.14: Sign in Page in Tamil

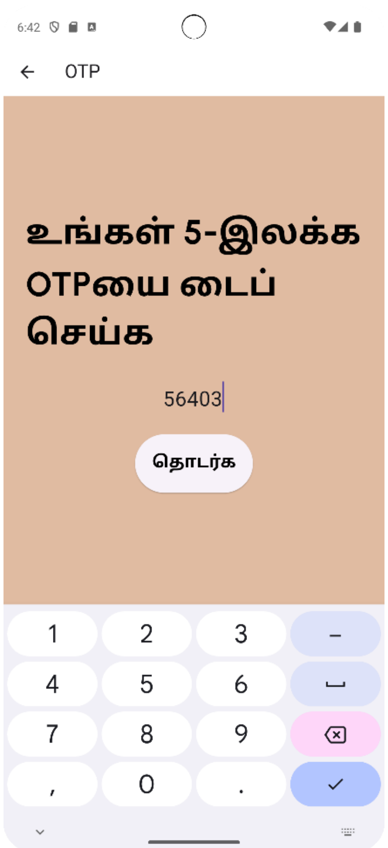


Fig 5.15: OTP Validation Page in Tamil

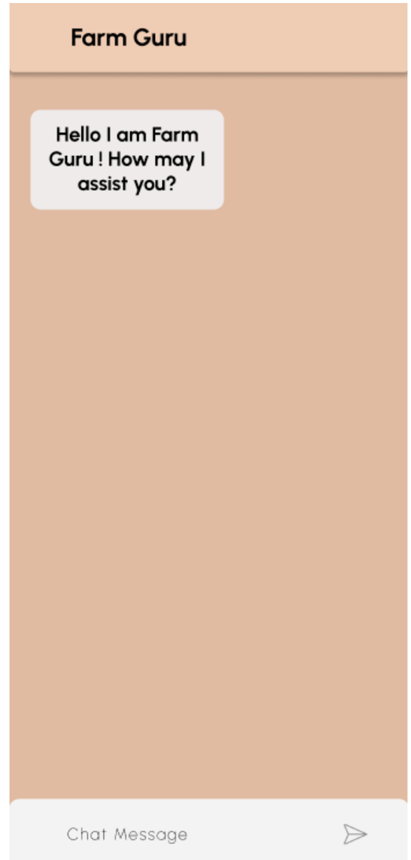


Fig 5.16: Farm Guru ChatBot

5.2 RESULT

Algorithm	Accuracy
Logistic Regression	96.36%
Naive Bayes	99.55%
Support Vector Machine	96.82%
K-Nearest Neighbors	95.91%
Decision Tree	98.41%
Random Forest	99.32%
Bagging	98.86%
AdaBoost	9.55%
Gradient Boosting	98.18%
Extra Trees	87.5%

Table 1 : Performance metrics of the Machine Learning Algorithms

The results of the AI-assisted farm app project showcase promising accuracy across various machine learning algorithms evaluated for crop suggestion. Logistic Regression exhibited a commendable accuracy of 96.36%, followed closely by Support Vector Machine with 96.82%, and Naive Bayes with an impressive accuracy of 99.55%. Decision Tree and Random Forest algorithms also demonstrated robust performance, achieving accuracies of 98.41% and 99.32%, respectively. K-Nearest Neighbors and Bagging algorithms yielded accuracies of 95.91% and 98.86%, respectively, further indicating their effectiveness in crop prediction tasks.

However, AdaBoost and Extra Trees algorithms displayed lower accuracies of 9.55% and 87.5%, respectively, suggesting limitations in their performance within this context. AdaBoost's lower accuracy may be attributed to challenges in effectively boosting weak learners, while Extra Trees may have struggled due to its inherent randomness in selecting splits. Nevertheless, Gradient Boosting showcased notable accuracy at

98.18%, indicating its efficacy in enhancing the performance of base models through iterative training.

Overall, the results highlight the suitability of certain algorithms, such as Naive Bayes and Random Forest, for accurate crop suggestion tasks within the farm app. These algorithms leverage different underlying principles, such as probabilistic modeling and ensemble learning, to effectively analyze agricultural data and provide valuable recommendations to farmers. Moving forward, further refinement and optimization of the selected algorithms can enhance the app's predictive capabilities, ensuring farmers receive reliable and actionable insights to improve their agricultural practices and maximize crop yields.

CHAPTER 6

CONCLUSION AND FUTURE ENHANCEMENT

6.1 CONCLUSION

In conclusion, the AI-assisted farm app signifies a transformative leap forward in agricultural technology, offering farmers an invaluable resource for optimizing crop selection and cultivation practices. With notable accuracy rates achieved by algorithms such as Naive Bayes, Random Forest, and Decision Tree, the app demonstrates its efficacy in providing reliable crop recommendations. Despite encountering lower accuracies with algorithms like AdaBoost and Extra Trees, ongoing refinement efforts hold promise for augmenting the app's predictive capabilities. Overall, the app stands as a pivotal tool for farmers, delivering real-time weather forecasts, personalized crop suggestions, and accessible features such as multi-language support and chatbot assistance. By harnessing the power of machine learning and data analytics, the app empowers farmers to make informed decisions, enhance agricultural productivity, and foster sustainable farming practices. As it continues to evolve and adapt to the needs of farmers, the app holds immense potential to revolutionize the agricultural landscape, driving efficiency, resilience, and prosperity within the farming community.

FUTURE ENHANCEMENT

In future iterations, the farm app could benefit from several enhancements to further elevate its utility and impact. Integration of advanced deep learning techniques could enhance predictive accuracy, enabling more precise crop recommendations. Additionally, incorporating real-time satellite imagery and IoT sensors could provide farmers with comprehensive insights into crop health and environmental conditions. Enhanced user engagement features, such as gamification elements or community forums, could foster knowledge sharing and collaboration among farmers. Moreover, expanding the app's functionalities to include farm management tools, market price analysis, and supply chain optimization could offer holistic support to farmers throughout the agricultural lifecycle. Lastly, continuous refinement of the app's user interface and accessibility features, coupled with ongoing updates based on user feedback and emerging technologies, will ensure that the app remains relevant, intuitive, and indispensable for farmers worldwide.

APPENDIX

SOURCE CODE:

Crop Recommendation code:

```
from sklearn.preprocessing import StandardScaler
sc = StandardScaler()
sc.fit(X_train)
X_train = sc.transform(X_train)
X_test = sc.transform(X_test)

from sklearn.linear_model import LogisticRegression
from sklearn.naive_bayes import GaussianNB
from sklearn.svm import SVC
from sklearn.neighbors import KNeighborsClassifier
from sklearn.tree import DecisionTreeClassifier
from sklearn.tree import ExtraTreeClassifier
from sklearn.ensemble import RandomForestClassifier
from sklearn.ensemble import BaggingClassifier
from sklearn.ensemble import GradientBoostingClassifier
from sklearn.ensemble import AdaBoostClassifier
from sklearn.metrics import accuracy_score

# create instances of all models
models = {
    'Logistic Regression': LogisticRegression(),
    'Naive Bayes': GaussianNB(),
    'Support Vector Machine': SVC(),
    'K-Nearest Neighbors': KNeighborsClassifier(),
    'Decision Tree': DecisionTreeClassifier(),
    'Random Forest': RandomForestClassifier(),
    'Bagging': BaggingClassifier(),
    'AdaBoost': AdaBoostClassifier(),
    'Gradient Boosting': GradientBoostingClassifier(),
    'Extra Trees': ExtraTreeClassifier(),
}

for name, md in models.items():
    md.fit(X_train,y_train)
```

```
    ypred = md.predict(X_test)
    print(f"{name}  with accuracy : {accuracy_score(y_test,ypred)}")

rfc = RandomForestClassifier()
rfc.fit(X_train,y_train)
ypred = rfc.predict(X_test)
accuracy_score(y_test,ypred)

N = 20
P = 50
k = 40
temperature = 30.0
humidity = 20
ph =33
rainfall = 40

predict = recommendation(N,P,k,temperature,humidity,ph,rainfall)

crop_dict = {1: "Rice", 2: "Maize", 3: "Jute", 4: "Cotton", 5: "Coconut", 6: "Papaya", 7:
"Orange",
                 8: "Apple", 9: "Muskmelon", 10: "Watermelon", 11: "Grapes", 12: "Mango",
13: "Banana",
                 14: "Pomegranate", 15: "Lentil", 16: "Blackgram", 17: "Mungbean", 18:
"Mothbeans",
                 19: "Pigeonpeas", 20: "Kidneybeans", 21: "Chickpea", 22: "Coffee"}

if predict[0] in crop_dict:
    crop = crop_dict[predict[0]]
    print("{} is the best crop to be cultivated ".format(crop))
else:
    print("Apologies we can't find a suitable crop.")
```

Weather Prediction Code:

```
import 'package:flutter/material.dart';
import 'package:http/http.dart' as http;
import 'dart:convert';
import 'CropsPage.dart';
import 'FertilizerPage.dart';
import 'IrrigatorPage.dart';
import 'ChatBot.dart';
class UserScreen extends StatefulWidget {
  @override
  _UserScreenState createState() => _UserScreenState();
  final String cityName;
  UserScreen({required this.cityName});
}

class _UserScreenState extends State<UserScreen> {
  Map<String, dynamic>? weatherData;
  final Color textHexColor = Color(0xffE0BBA1);
  String?_cityName;

  @override
  void initState() {
    super.initState();
    _cityName = widget.cityName;
    fetchWeatherData(_cityName!); // Replace 'Chennai' with your desired city
  }

  Future<void> fetchWeatherData(String city) async {
    final apiKey = 'c02db4bb792bc0bf22cda2bd53e7e706'; // Replace with your actual
API key
    final url =
Uri.parse('https://api.openweathermap.org/data/2.5/weather?q=$city&appid=$apiKey&
units=metric');
    final response = await http.get(url);

    if (response.statusCode == 200) {
      setState(() {
        weatherData = jsonDecode(response.body);
      });
    } else {
      throw Exception('Failed to fetch weather data');
```

```
    }
  }

  @override
  Widget build(BuildContext context) {
    return Scaffold(

      appBar: AppBar(
        backgroundColor: Colors.white,
        title: const Text("Welcome to Farm Friend"),
        leading: IconButton(
          icon: const Icon(Icons.arrow_back),
          onPressed: () {
            Navigator.pop(context);
          },
        ),
      ),
      body: Stack(
        children: [
          Container(
            color: textHexColor,
            child: Column(
              children: [
                Container(
                  padding: EdgeInsets.symmetric(horizontal: 16, vertical: 16),
                  child: WeatherCard(weatherData: weatherData),
                ),
                Expanded(
                  child: GridView.count(
                    crossAxisCount: 2,
                    padding: EdgeInsets.all(16.0),
                    mainAxisSpacing: 16.0,
                    crossAxisSpacing: 16.0,
                    children: [
                      GestureDetector(
                        onTap: () {
                          // Navigate to the Crops page
                          Navigator.push(
                            context,
                            MaterialPageRoute(builder: (context) => CropsPage()),
                          );
                        },
```

```
  child: Card(
    child: Column(
      mainAxisAlignment: MainAxisAlignment.center,
      children: [
        Image.asset('assets/crop.png', width: 78.0, height: 78.0),
        const SizedBox(height: 8.0),
        const Text('Crops'),
      ],
    ),
  ),
),
GestureDetector(
  onTap: () {
    // Navigate to the Crops page
    Navigator.push(
      context,
      MaterialPageRoute(builder: (context) => FertilizerPage()),
    );
  },
  child:  Card(
    child: Column(
      mainAxisAlignment: MainAxisAlignment.center,
      children: [
        Image.asset('assets/fertilizer.png', width: 78.0, height: 78.0),
        SizedBox(height: 8.0),
        Text('Fertilizer'),
      ],
    ),
  ),
),
GestureDetector(
  onTap: () {
    // Navigate to the Crops page
    Navigator.push(
      context,
      MaterialPageRoute(builder: (context) => IrrigatorPage()),
    );
  },
  child: Card(
    child: Column(
      mainAxisAlignment: MainAxisAlignment.center,
      children: [
```

```
                    Image.asset('assets/irrigation-system.png', width: 78.0, height: 78.0),
                    SizedBox(height: 8.0),
                    Text('Irrigator'),
                  ],
                ),
              ),
            ),
            GestureDetector(
              onTap: () {
                // Navigate to the Crops page
                Navigator.push(
                  context,
                  MaterialPageRoute(builder: (context) => ChatBot()),
                );
              },
              child: Card(
                child: Column(
                  mainAxisAlignment: MainAxisAlignment.center,
                  children: [
                    Image.asset('assets/chatbot.png', width: 78.0, height: 78.0),
                    SizedBox(height: 8.0),
                    Text('Farm Guru'),
                  ],
                ),
              ),
            ),
          ],
        ),

      ),
    ],
  ),
),
],
),
);
}
}


class WeatherCard extends StatelessWidget {
  final Map<String, dynamic>? weatherData;
```

```
WeatherCard({required this.weatherData});

@override
Widget build(BuildContext context) {
  if (weatherData == null) {
    return Container(
      height: 150,
      child: Center(
        child: CircularProgressIndicator(),
      ),
    );
  }

  final temperature = weatherData!['main']['temp'];
  final weatherDescription = weatherData!['weather'][0]['description'];
  final humidityStatus = 'Good';
  final soilMoistureStatus = 'Good';
  final precipitationStatus = 'Low';

  return Container(
    width: double.infinity,
    height: 130,
    padding: EdgeInsets.symmetric(horizontal: 16, vertical: 8),
    decoration: BoxDecoration(
      color: Colors.amber[100],
      borderRadius: BorderRadius.horizontal(
        left: Radius.circular(20),
        right: Radius.circular(20),
      ),
    ),
    child: Column(
      crossAxisAlignment: CrossAxisAlignment.start,
      children: [
        Row(
          mainAxisAlignment: MainAxisAlignment.spaceBetween,
          children: [
            Image.asset('assets/sun.png',width: 38.0, height: 38.0, ),
            Text(
              '${temperature.toInt()}°C',
              style: TextStyle(
                fontSize: 24,
```

```
              fontWeight: FontWeight.bold,
            ),
          ),
          Text(
            weatherDescription,
            style: TextStyle(
              fontSize: 20,
            ),
          ),
        ],
      ),
      SizedBox(height: 20),
      Row(
        mainAxisAlignment: MainAxisAlignment.spaceBetween,
        children: [
          StatusItem(label: 'Humidity', status: humidityStatus),
          StatusItem(label: 'Soil Moisture', status: soilMoistureStatus),
          StatusItem(label: 'Precipitation', status: precipitationStatus),
        ],
      ),
    ],
  ),
 );
 }
}

class StatusItem extends StatelessWidget {
  final String label;
  final String status;

  StatusItem({required this.label, required this.status});

  @override
  Widget build(BuildContext context) {
    return Column(
      children: [
        Text(
          status,
          style: TextStyle(
            fontWeight: FontWeight.bold,
            fontSize: 16,
          ),
```

```
        ),
        SizedBox(height: 10),
        Text(
          label,
          style: TextStyle(
            fontSize: 12,
          ),
        ),
      ],
    );
  }
}
```

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