Project Report

Project - 2

Agriguru:Harvesting The Future

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Department of Computer Science and Engineering

School of Engineering and Technology

BML Munjal University

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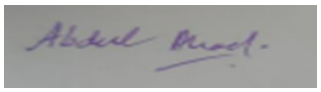
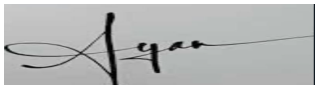
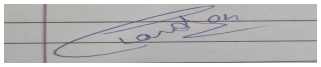
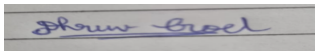
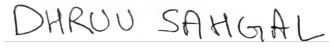
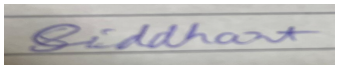
Declaration by the Candidates

We hereby declare that the project entitled ***"Agriguru:Harvesting The Future***" has been carried out for fulfilling the partial requirements for completion of the course on **Project 2** offered at the 4th Semester of the Bachelor of Technology (B.Tech) program in the Department of Computer Science and Engineering during **Annual Year 2022-23** in the 4th semester. This work has been carried out by us and submitted to the course instructor ***Dr. Nishtha Phutela***. Due acknowledgments have been made in the project to all the other materials used. This project has been done in full compliance with the requirements and constraints of the prescribed curriculum.

Group Members	**Signature**
Abdul Ahad	
Ayan Yezdani	
Chandan Dhingra	
Dhruv Goel	
Dhruv Sahgal	
Siddhant Sharma	
Pratyut	

Place: BML Munjal University

Date: 20 April 2023

Contents

Abstract

Agriculture plays a vital role in India's economy. In our country, approximately 54.6% of the total workforce is engaged in agricultural and allied sector activites.Farmer's agricultural experiences can be made simpler and better with the help of our Innovative, user friendly smartphone app Agriguru.. Despite rising demands for food , farmers face a variety of difficulties such as crop failures, low yields, and uncertain market conditions. This inspired us to create Agriguru,a complete tool designed to support farmers in making decisions and succeeding in their agricultural activities.

The app's features include crop prediction based on NPK and climatic values, best pricing prediction based on location, and fertilizer advice for optimum growth. The app also provides the user access to accurate updates on the agricultural information.

Our approach involved making and deploying 3 unique machine learning models like crop prediction, pricing prediction, and fertilizer recommendation.These models were developed using three different dataset that consisted of information on the soil(NPK values), the climate, and other pertinent variables.we used various evaluation metrics like R2 score, accuracy, and confusion matrix to assess the performance of these models.

for the user experience and usability testing of Agriguru, a user study involving farmers,faculty and peers was carried out as part of the Agriguru evaluation. The results demonstrated that farmers thought the software was user friendly and very easy to use with multi language support.

Agriguru, in conclusion, is a useful tool for farmers since it gives them access to pertinent information, reliable predictions and recommendations,and a user-friendly design. Through our app we could raise yields, decrease losses, and boost agricultural output. Through the use of Agriguru, farmers can make well-informed decisions, lower their risk , and succeed in their agricultural goals and thus improving their lifestyle.

1.1 Introduction

Our nations' economies relies heavily on agriculture. Over the past 10 years, we have seen a huge surge in food requirements due to population growth.However, there is still a limited supply of arable land and other natural resources that can be used, so it is necessary to use them as effectively as we can to transition to a sustainable agricultural practice.So, to assist farmers in dealing with this, our team created the app Agriguru.

Motivation

Agriguru is driven by the problems faced by small-scale farmers of our country, who lack access to required latest harvesting technologies and tools and struggle to make informed crop selection decisions. As a consequence, crop yields and earnings may suffer, adding to food insecurity. Our app strives to strengthen farmers by giving them a technology-based solution for optimizing crop selection. Agriguru is been created for farmers with less technical knowledge by using a basic UI that uses simple functions with multi language support.
By optimizing crop selection, Agriguru can help farmers use natural resources more efficiently and sustainably. This can lead to more productive and sustainable farming practices, ensuring the long-term viability of agriculture as a means of food production.Overall, Agriguru is motivated by a desire to improve the lives of farmers and promote sustainable agriculture.

Product Description

Agriguru , a crop prediction APP helps farmers choosing the best crops to harvest on the basis of severa; nutrients like NPK(nitrogen,phosphate,potassium) levels and climate conditions of the user.Our app can tell the top 3 crops for a specific environment, and will also assist farmers in predicting the ideal selling price of their harvests in order to maximize revenues. Furthermore, the app also recommends the best fertilizer to use to improve the yield of the harvested crops.

Agriguru assists farmers by leveraging machine learning and data analysis leading to increased yields and profitability. Agriguru is designed to be accessible to farmers with low technology skills, with a user-friendly UI and intuitive features built using Flutter, making it an essential tool for small-scale farmers in India.

Why is this product required?

Crop selection is a subjective process that is frequently based on the farmer's experience and intuition. Our app will not only assist farmers in making educated decisions, but it will also optimize the use of natural resources such as land and water. This will result in higher crop yields and less waste, resulting in more sustainable agriculture methods.

Real-World Implications:

Agriguru can transform India's agriculture sector by offering farmers a prediction-based solution for optimizing harvesting process. This can result in higher food output, decreased waste, and more environmentally friendly agriculture techniques. The software may also provide economic benefits by allowing farmers to maximize their revenues by selecting the best produce and selling it at the best price.

The ability of our app to predict the best crops to grow based on soil nutrients and climate conditions, recommend the type of fertilizer to use,and predict suitable prices to sell the crop has a significant impact on the lives of farmers,the environment, and broader social and economic development goals.

1.2 Survey of existing solutions

1. Microsoft Farmbeats

Microsoft's FarmBeats service collects required inputs on soil moisture, temperature, humidity, and other factors that affect crop development by utilizing a combination of sensors, drones, and algorithms. The platform also includes a mobile app that gives farmers high level real-time insights and recommendations based on the data collect.

Dataset : they are collecting data through sensors and drones installed on farms, and the process involves the use of machine learning algorithms to analyze the data and make required recommendations to the farmers.

FarmBeats has passed through usability and user experience testing, but one of its main drawbacks is that it requires plenty of investment in infrastructure and technology, which may be too costly for small-scale farmers.

2. Plantix

PEAT GmbH created the Plantix employs picture recognition tech. to figure out the nutrient deficits and plant illnesses and then give farmers advice on how to treat and prevent them.

Dataset: The dataset utilized in Plantix was collected through crowdsourcing, in which different users submitted photos of their crops to the application. The methodology involves using M.L. algorithms to analyze the pictures and give recommendations to farmers.

Plantix has been tested for usability and user experience, and is widely utilized by farmers in developing

countries. However, one of the **limitations** is that it is primarily focused on identifying plant diseases and nutrient deficiencies, and does not provide recommendations for crop selection or fertilizer usage.

3. Climate FieldView

Climate FieldView gives farmers in-the-moment observations and suggestions for crop management through the use of sensors, weather data, and machine learning algorithms.

Dataset: The farm's sensors and other weather data sources were used to collect the dataset that was used in Climate FieldView.

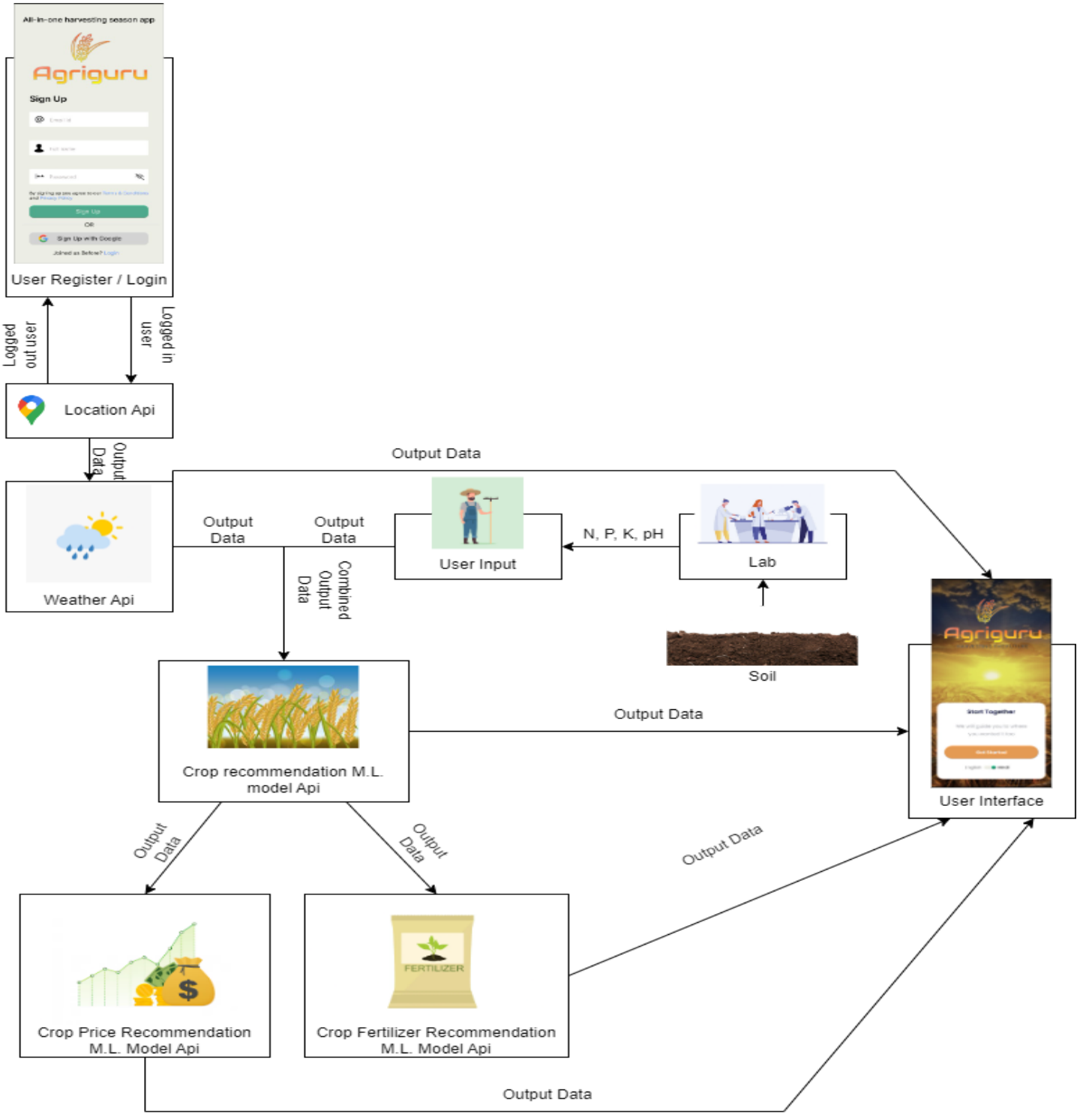
In order to assess the information and give advice to farmers, the methodology uses M.L. algorithms. Farmers in North America frequently utilize Climate FieldView, which has undergone evaluation for usability and user experience. Its requirement for a fee is one of its drawbacks; small-scale farmers in developing nations might not be able to afford it.

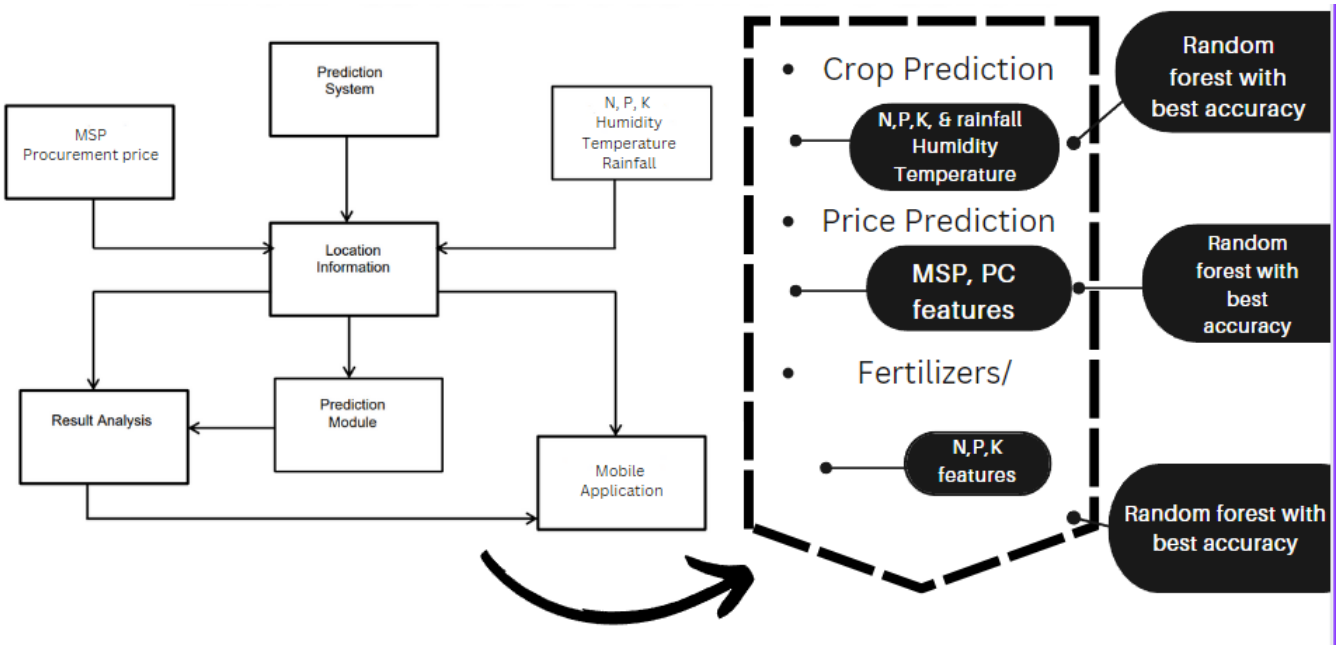
Product	Functionality	Data Used	Usability Evaluation	User Experience	Limitations
Farmbeats	provides farmers with real-time insights and recommendations	sensors and drones placed on the farm	The interface is complex, and maybe challenging for some users to understand and implement.	Generally positive feedback, with some users expressing concerns about the accuracy of the predictions.	Significant investment in Hardware
Plantix	image recognition technology to identify plant diseases and	Image data	Highly intuitive and user-friendly interface.	some users expressing concerns over	only focused on identifying plant diseases and

Product	Functionality	Data Used	Usability Evaluation	User Experience	Limitations
	nutrient deficiencies		Some users reported difficulty in capturing clear images for analysis	limitation of the features	nutrient deficiencies
Climate FieldView	Real-time insights and recommendations for crop management.	sensors placed on the farm, as well as through weather data sources.	Highly customizable interface with a wide range of features. Some users reported a steep learning curve.	Generally positive feedback on user experience, with some users reporting slow loading times.	A subscription Fee
Agriguru	Provide crop recommendations, optimum price and fertilizer information	Soil nutrient data, climate data,	Easy to use interface, intuitive design. Multi-language Support	provides users with personalized recommendations, feedback of a valuable tool for farmers	Requires data input from farmers or lab results for soil nutrient analysis,which may not be available in remote areas

2.System

System architecture:





Features:

Sr no.	Feature	Associated design	Significance of feature
1.	Weather and location API used	Visibility of system status	To give live weather conditions in their area, including temperature, rainfall, and humidity.
2	Input values of features.	User control and freedom	users can make more informed decisions about their agricultural activities.
3	Hindi-English toggle button.	User-centered design	Help to change language, which might be a barrier in using the app.

4.	Bottom Nav Bar	Navigation	A bottom navigation bar is a useful feature that provides easy navigation.
5.	Color Scheme	Harmony	The significance of a complementary color scheme is that it can create a dynamic and energetic visual experience for users.

Tech Stack

The system architecture of Stockly includes several components that work together to provide a seamless user experience.The below table outlines all the components and their use in our application.

Component	Purpose
Flutter	The mobile application is built using Flutter Framework providing a fast and efficient solution to cross platform app building .
Dart	Flutter framework uses Dart as its programming language.
Python	Python is used to perform machine

	learning algorithms to make all the predictions.
Weather Api	The API helps to get the weather data which is used for machine learning training and testing.
Firebase	The user details are stored on Firebase which is a cloud based platform. User Authentication and user data fetching is done using firebase.
Flask	Flask is lightweight and easy to use, making it a great choice for small to medium-sized projects. Flask is used for deploying the three M.L. models.
Azure	Azure is a cloud computing service by Microsoft that offers a wide range of services and tools to build, deploy and manage various applications. It is here used to Deploy our models.

3.Methodology

The methodology for the Agriguru app involves 3 main components: machine learning (ML) using the CRISP-DM framework, human-computer interaction (HCI) through experiment design, and mobile application development (MAD) using the Flutter framework.

CRISP-DM

1.Crop prediction model

Business Understanding: The goal of this model is to predict the top three crops that are mostly suitable for increasing the yield of the crop given a combination of NPK values and weather. data

Data Understanding:

Data fields

1.N - ratio of Nitrogen content in soil
2.P - ratio of Phosphorus content in soil
3.K - ratio of Potassium content in soil
4.temperature - temperature in degree Celsius
5.humidity - relative humidity in %
6.pH - pH value of the Soil
7.Rainfall - rainfall in mm

Data Preparation: : In the dataset , there are no null or duplicate values. For each crop there are exactly 100 data points.

Modeling: Several machine learning algorithms are trained and evaluated on the training set. The algorithm with the highest accuracy is selected.

Evaluation: The selected algorithm is evaluated on the testing set using various performance metrics such as accuracy, precision, recall, and F1-score.

Deployment: The model is deployed by making an api which is being integrated with the flutter app.

2.Crop Price Prediction Model

Business Understanding: Using past data, this project's goal is to forecast agricultural prices. The model can be used to forecast the future and assist farmers in making wise decisions.

Data Understanding: The information was gathered from a historical crop price CSV file. The data is looked into and a preliminary data analysis is done. Following were the features.

- commodity_name
- State
- District
- market
- min_price
- max_price
- modal_price
- date

Data Preparation : Reading the data: CSV file containing agricultural crop prices data is read using pandas library.

1. Data Cleaning: Checking for missing values and replacing them with NaN values using 'na_values' parameter in the read_csv() function.

2. Data Exploration: Exploring the data by checking the columns, data types of each column, and number of missing values in each column using info() and isnull().sum() functions.
3. Feature Engineering:
    - Creating a new column 'month_column' from the 'date' column, which extracts the month information from the date.
    - Creating a new column 'season_names' from 'month_column' column, which assigns a season name to each month.
    - Creating a new column 'day' from the 'date' column, which extracts the day of the week information from the date.
5. Outlier Treatment:
    - Checking for outliers in the 'modal_price' column using boxplot and calculating the IQR.
    - Dropping the rows with outlier values in the 'modal_price' column using upper and lower limits.
6. Data Visualization: Visualizing the data using various plots like boxplot, scatterplot, line plot, and barplot, to gain insights into the data and explore relationships between variables.
7. Data Encoding: Encoding categorical variables like 'commodity_name', 'state', and 'district' into numerical values using dictionaries.

Modeling: Several machine learning models are implemented and trained using the preprocessed data from the previous section in the code's Modelling section.

Using the testing dataset, each model's r2 score is assessed after training, and the results are printed. The model that predicts the most accurately is chosen as the final model and applied to brand-new, unforeseen data.

The preprocessed data are first split into training and testing datasets using a train-test split. Following that, the training dataset is used to train the following machine learning models:

Evaluation: The selected algorithm is evaluated on the testing set using r2 score.

Deployment: The model is deployed by using flask and making api which is later integrated with the flutter app.

3.Fertilizer Prediction Model

Business Understanding: The goal of this model is to predict the fertilizer that is most suitable for increasing the yield of the crop given a combination of NPK values, Soil type , and Crop type.

Data Understanding:

Data fields

1.N - ratio of Nitrogen content in soil
2.P - ratio of Phosphorus content in soil
3.K - ratio of Potassium content in soil
4.temperature - temperature in degree Celsius
5.humidity - relative humidity in %
6.Soil Type - type of the soil
7.Crop Type - name of the crop
8**.Fertilizer** - name of the Fertilizer

Data Preparation: : The Soil Type and Crop Type variables are categorical variables that are encoded using LabelEncoder. This converts the categorical variables into numerical values so that they can be used as input for machine learning algorithms.he dataset is split into training and testing sets using train_test_split.

Modeling: Several machine learning algorithms are trained and evaluated on the training set. The algorithm with the highest accuracy is selected.

Evaluation: The selected algorithm is evaluated on the testing set using various performance metrics such as accuracy, precision, recall, and F1-score.

Deployment: The model is deployed by making an api using Flask and that api is being integrated with the flutter app for farmers to use .

Human Computer Interaction (HCI)

Usability Test: In this study, the usability of our app will be assessed. As they use our app to complete a series of tasks, participants' interactions will be observed and recorded. The findings will be used to pinpoint problems with usability and potential areas for development.

Some test we used:

1. You wish to make an account on the app as a new user. Activate the app by entering your email address and password.
2. What kind of crop is best suited for growing in your region is something you want to know. Get recommendations based on the local weather and soil conditions with the app.
3. You're curious about the best fertilizer to use in your region to grow the suggested crop. Get recommendations based on the local weather and soil conditions with the app.
4. You wish to introduce your other farmers to the app. Create a sharing link using the app, or invite friends to download it.

Result: As a result of this experiment, it was possible to pinpoint specific areas where the app could be made more user-friendly, such as by modifying the language of some prompts and streamlining the navigation.

A/B Testing of Color Themes: The impact of several colour schemes on the user experience is assessed in this experiment. Participants were split into two groups at random and shown either the current colour scheme or a brand-new one. They were then given a series of tasks to complete, and their results were compared.

Result: The experiment's findings demonstrated that people prefer the new colour scheme (the Light theme), which also boosts user satisfaction and engagement.

Survey of Language Preferences: The effectiveness of the language options in our app was tested in this experiment. Participants were required to respond to a survey regarding their preferred languages and how they found using the programme in those languages.

Result: The findings of this study showed that when software is available in users' local tongues, it is more interesting and valuable to them.

User Feedback Session: Through user feedback, this experiment assesses the overall user experience of our app. The usability, design, and functionalities of the app were subject to participant input.

Result: A variety of comments about the app were included in the experiment's findings. The app will be enhanced and made more user-friendly using this feedback.

Mobile Application Development - Flutter(Dart)

Flutter is an adaptable framework which we can use for creating mobile apps, and it is a great option for many factors. we chose Flutter for our app development largely due to Flutter's capability to produce aesthetically pleasing and responsive UIs quickly and in no time.The large library of styles and themes pre-built in Flutter, along with its widget-based architecture that gives developer the power to create beautiful and appealing user interfaces.

we have used the following flutter features in our app:

Multi-language support: This feature assists us in quickly designing an app support multiple languages because of the Flutter's built-in services such as internationalisation and localization functionality . We have given user a choice to switch between English and Hindi by adding Hindi language support to our app..

Flutter's location plugin: this plugin offers an easy approach to use a platform-specific service to find out the user's location. Once the user has given us permission to access their location, we can use the plugin to retrieve the user's current location's coordinates.Once we know the user's precise location, Using Weather API we can request the weather information around the user. The Weather Api provides various meteorological

information, such as temperature, humidity, and more.

Firebase Authentication: For user authentication in mobile and web apps, we are using a well-known service called Firebase Authentication.all the users will be able to Sign Up or Sign In to our app using basic email and password.Other than this , the user can also use Google for Authentication , using its secure and user-friendly authentication system.

Widgets: The foundation of Flutter is the idea of widgets, which form the skeleton of the user interface. To design the various UI elements in our app, such as buttons, text fields, navbars, and appbars, we used a variety of built-in and custom widgets.

Text Widget: Text widget is used to display the text,Labels, directions, and other text-based material in Agriguru .

RaisedButton Widget: The RaisedButton widget is used to create all the buttons for our app. We have used this RaisedButton to create buttons for taking input like submitting values, navigating to different screens, and performing other actions.

Image Widget: This widget is used to display images of crops, fertilizers, and other relevant images in our app.

Container Widget: The Container widget is used to group widgets together and provide styling and layout options. We have used this widget to create custom layouts and to style other widgets in our app.

ListView Widget: This widget was used in our app to display a scrollable list of items. We have used this widget to display crops, fertilizers, and other relevant items in a list format.

Switch Widget: The Switch widget is used to allow users to toggle a setting on or off. We have used this widget to allow users to switch between English and Hindi in our app.

FutureBuilder Widget: we have used FutureBuilder widget to asynchronously build widgets based on data in the Future..

AppBar Widget: Our app's top app bar,which normally includes a title, actions, and navigation buttons, is made using the AppBar widget.We have displayed our logo and user profile symbol using this widget. These items are displayed using the AppBar widget, which establishes a dependable design pattern that consumers can quickly identify and comprehend.

BottomNavigationBar Widget: Agriguru navigation Bar has icons and labels to navigate through the app , which is built using the BottomNavigationBar widget. With the help of this widget, users can easily navigate between the various parts of our app and access crucial features.

Navigator widget: An important Flutter widget that provides navigation through multiple screens or pages of Agriguru.We have used this to add new routes to the stack and remove routes from the stack to move back to the previous screen. We have included a navigator in our app to move between the many areas or functions of our app

Icon widget: It is a crucial and often used widget in Flutter.When displaying buttons, menus, or other UI elements in an app, it can display a wide range of different icons and symbols.To display buttons and other UI components in our programme that need symbols or icons to express their function to the user, we used icons.

SizedBox widget: A widget in Flutter used to create a specific width,height, or both box.We used this feature to add enough spacing between widgets , such as creating margins or padding between UI elements.

Padding widget: It is a Flutter widget that creates white space around a child widget, such as padding or margins around the edges of a container or text field.To precisely regulate the spacing and arrangement of UI elements, padding can be adjusted with exact values for each edge.

Stateful and Stateless widgets: Stateless widgets are used for Constant static UI components,

including of things such as app bar's logo.

Stateful widgets are used for making dynamic UI elements, for example, a list of suggested fertilisers for a certain crop, that gets changes on getting the user input. we deployed stateful widgets to control the app's state, such as the login and signup screens..

4. Results

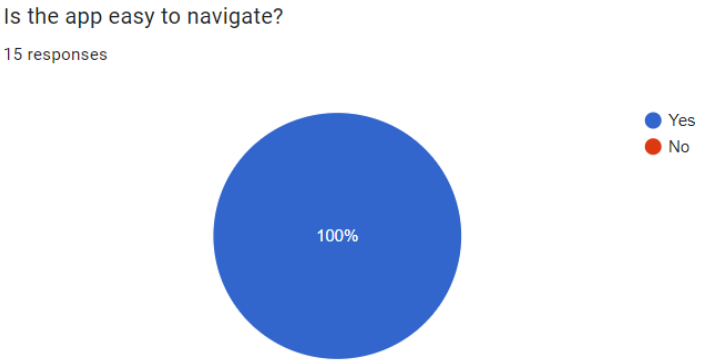
Usability Evaluation Results :-

Iterations	Duration	No. of participants	Type of participants	Method of feedback	Types of Usability Issue	Improvement from previous iteration
1.	1 week	5	Non-target Users	Informal Feedback	Cluttered Interface	Our prior dashboard layout displayed a lot of data, but some of it was superfluous and cluttered the interface. Some users experienced overwhelm as a result and struggled to locate the information they required. We took a step back to assess which pieces of

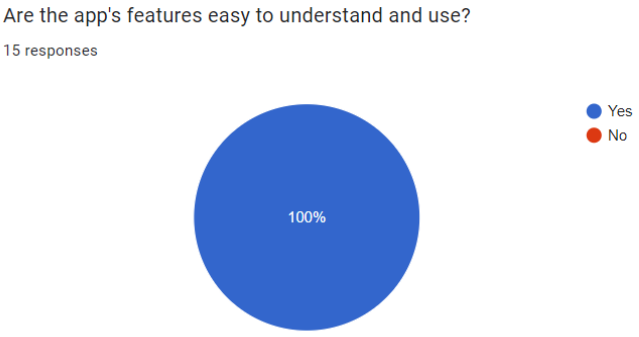
Iterations	Duration	No. of participants	Type of participants	Method of feedback	Types of Usability Issue	Improvement from previous iteration
						information were actually important for our users in order to address this issue.The end result was a dashboard that was simpler and easier to use, and users liked it. The new design has received positive feedback from our users for being more simple to use and comprehend.
2.	1 week	1	Non Targeted	Oral feedback	Multi-lingual support	The change is the addition of a language switch on the app's home page, which now supports both Hindi and English. This increases the app's accessibility to a broader audience of users, especially those who do not

Iterations	Duration	No. of participants	Type of participants	Method of feedback	Types of Usability Issue	Improvement from previous iteration
						speak English well, and is likely to boost engagement and user happiness.
3.	2 weeks	14	Targeted User	Survey	Lagging	Using the application exhibited significant lagging as a result of the async function's utilisation of inputs from many Apis. By synchronising the async function and ensuring that data is available before any actual interactions occurred, we were able to eliminate the lag in 2 weeks.
4.	1 week	2	Targeted User	Formal interview	Lab support	A farmer might not be able to obtain accurate soil test results from a crop prediction programme if there are no labs available in the area. Additionally, farmers might have to travel a great distance

Iterations	Duration	No. of participants	Type of participants	Method of feedback	Types of Usability Issue	Improvement from previous iteration
						to get their soil tested if there are no nearby labs available.

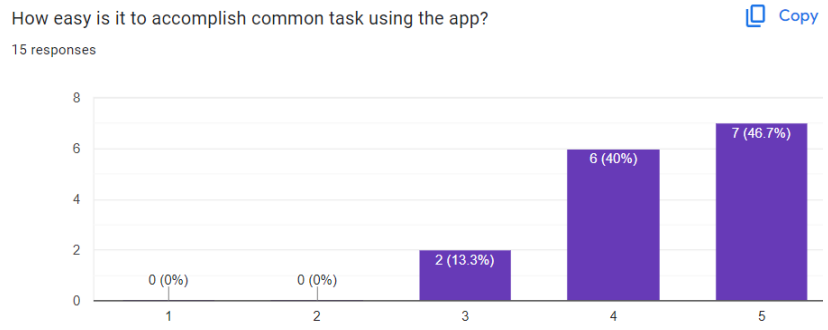


The above figure shows the response of users stating whether the app is easy to use or not.



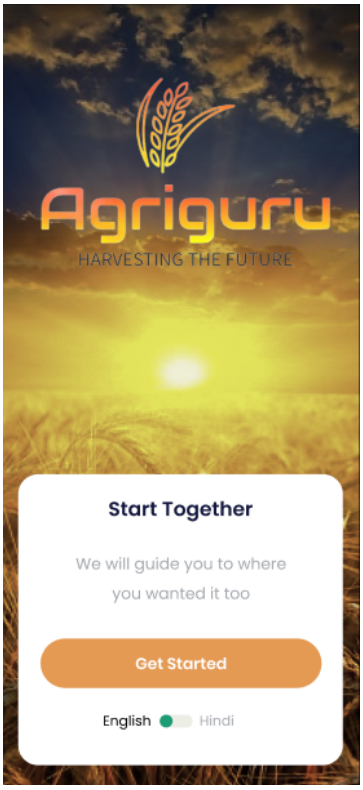
The above figure shows the response of users stating whether the app features are easy to understand or not.

The above figure shows the response of users stating whether accomplishing a common task in our app is easy

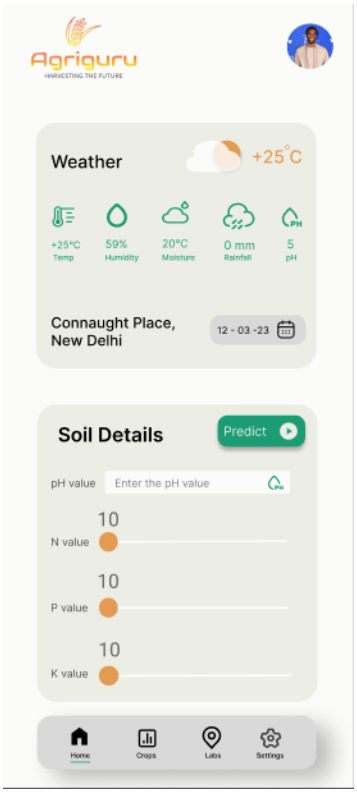


or difficult (1 - very difficult , 5- very easy).

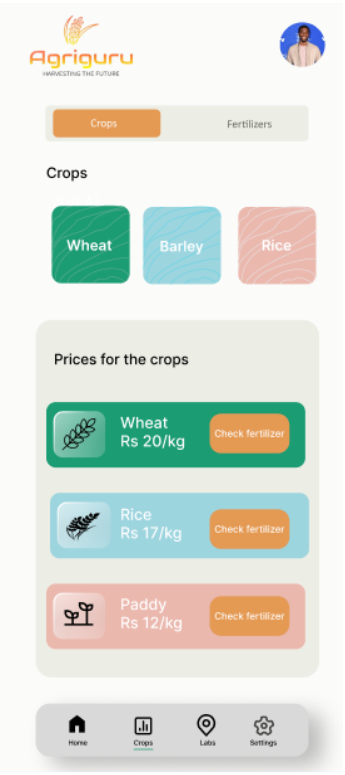
UI :-



Landing Page

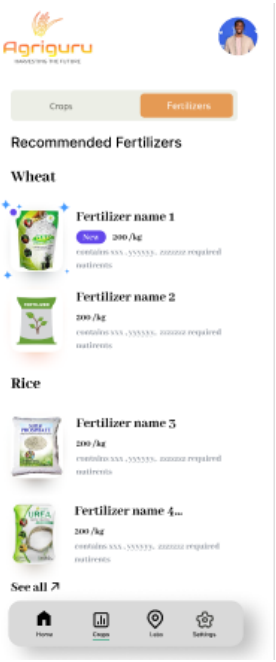


Home page

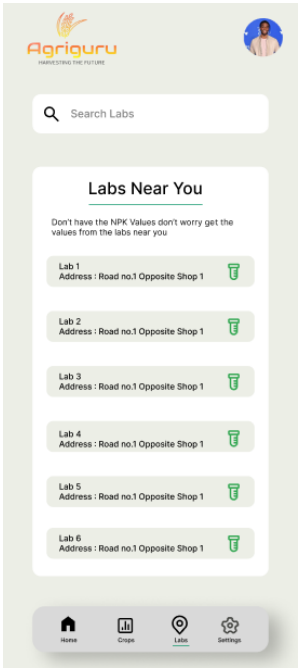


Prediction Page

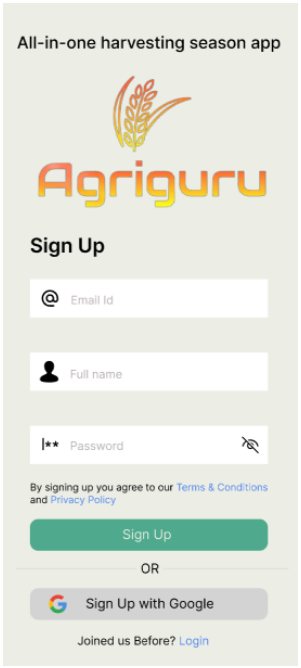
Fertilizer Page



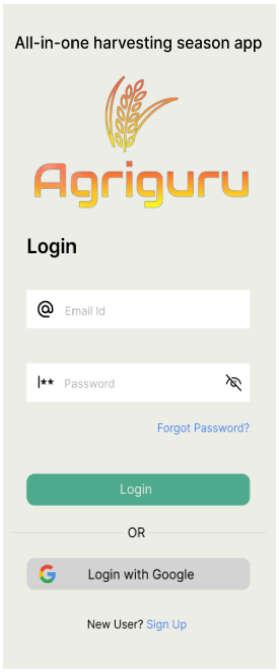
Lab's Page



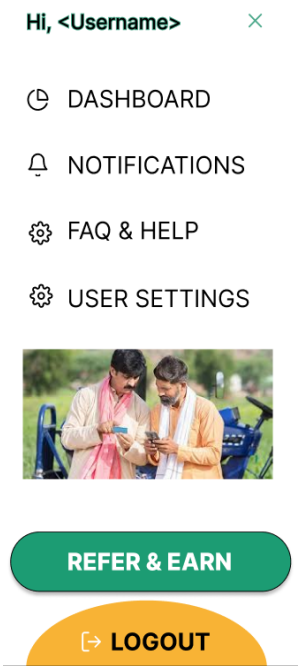
Sign Up Page



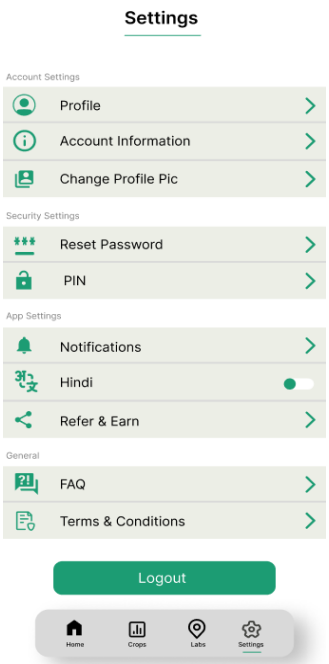
Login Page



User Profile Page

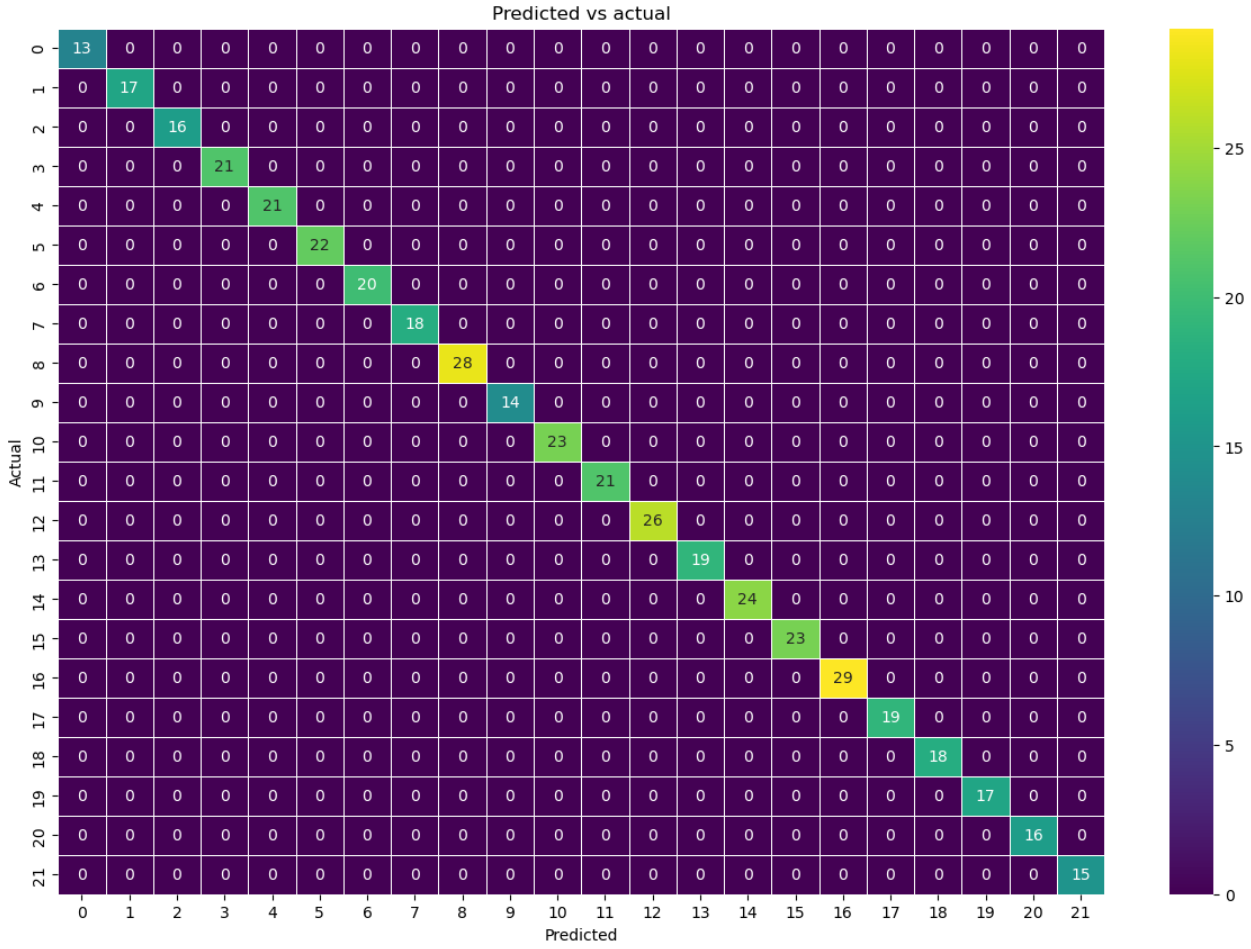


Setting's Page



1. Crop Prediction

Algorithm	Accuracy
K Nearest Neighbours	98.31
Naive Bayes	99.50
Decision Tree	94.90
Random Forest	99.09



The above figure shows confusion matrix of prediction by random forest classifier.

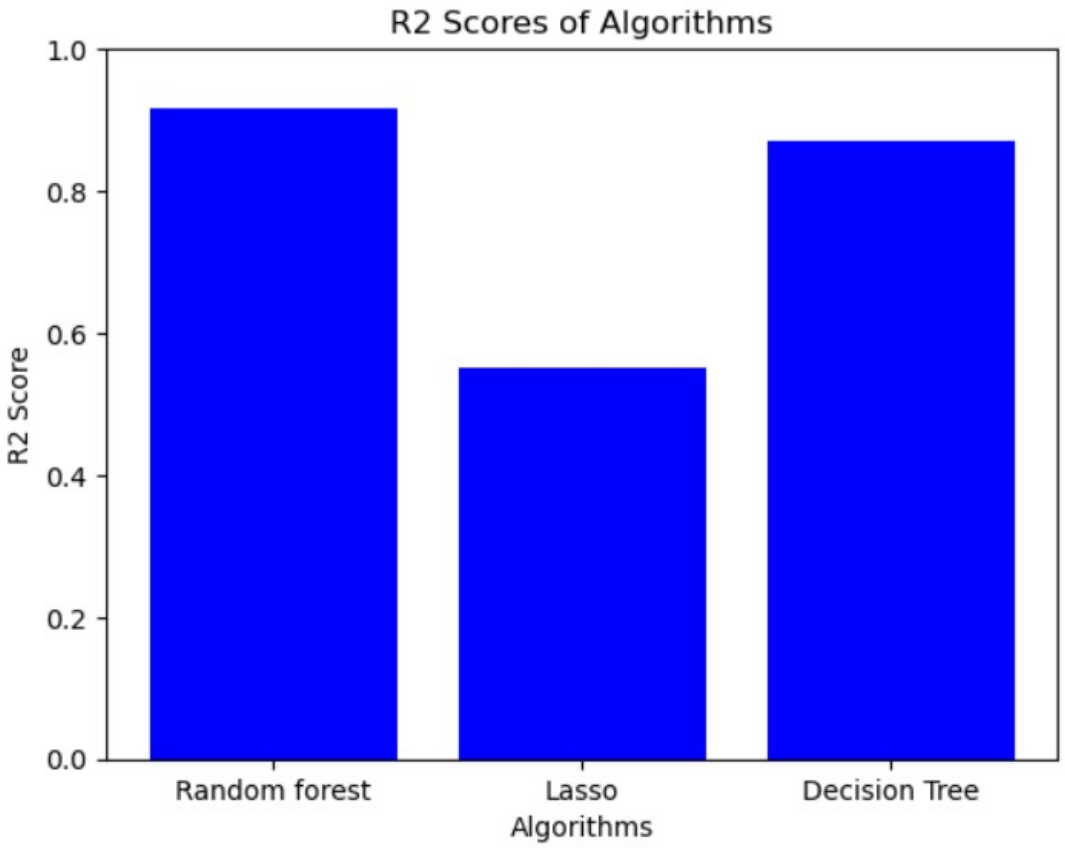
2. Crop price Prediction

The preprocessed data are first split into training and testing datasets using a train-test split. Following that, the training dataset is used to train the following machine learning models:

The selected algorithm is evaluated on the testing set using r2 score.

Algorithm	r2 score in percentage

Logistic Random Forest Classifier Regression	91.65%
Support Vector Machine (SVM) Classifier using Naive Bayes	87%
Lasso regression	55.16%



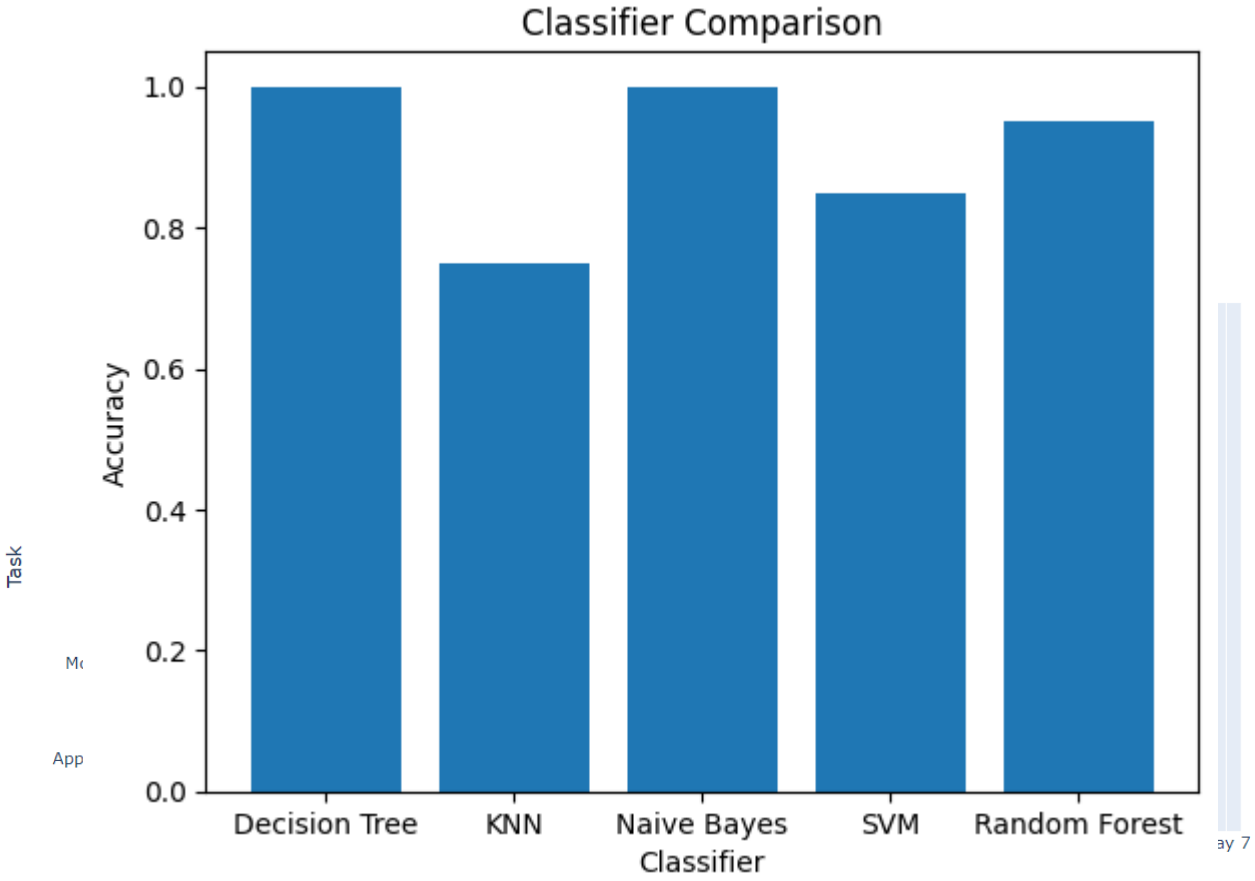
3. Fertilizer Prediction Model

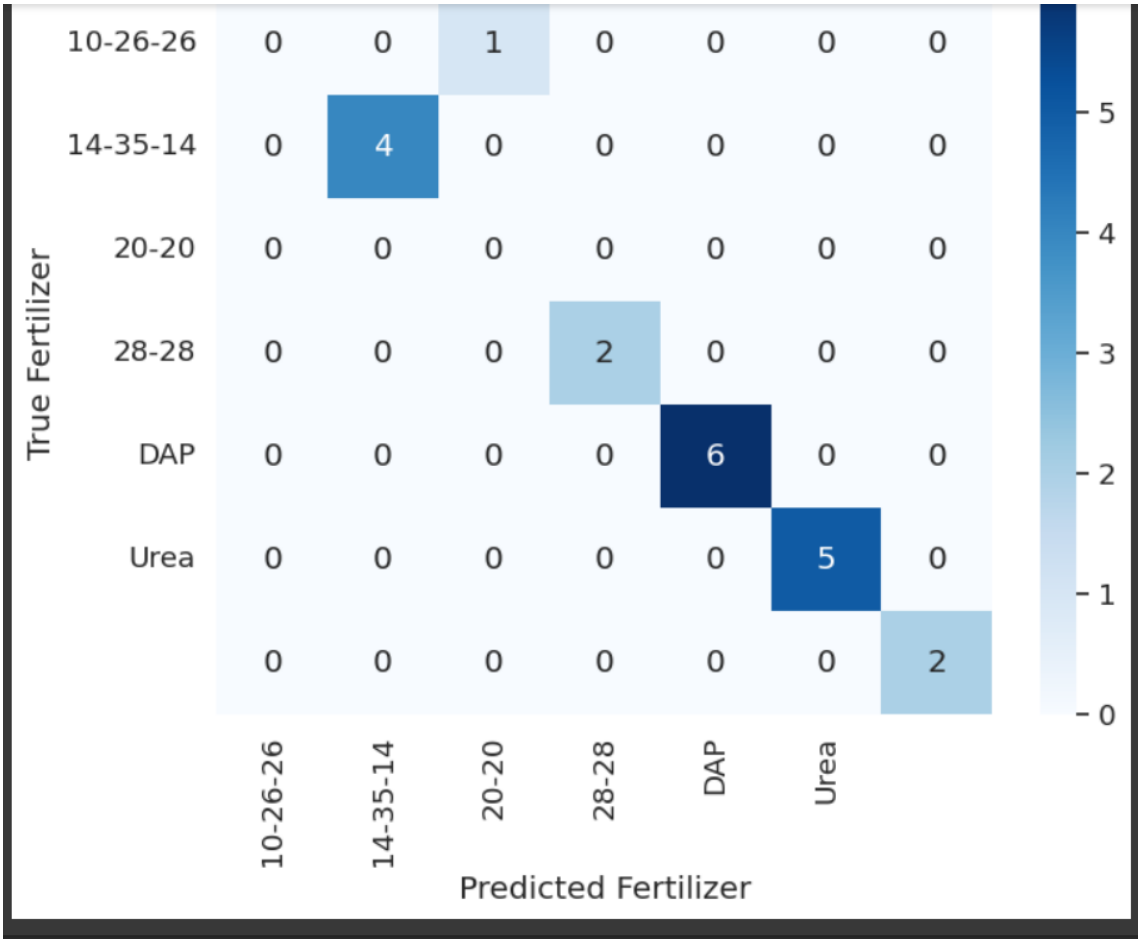
The Random Forest algorithm outperformed the other models based on accuracy ratings expressed as a percentage. With a 95% accuracy rating, it fared better than the Decision Tree (100% overfitted), KNN (75%), Naive Bayes (100%), and SVM (85%).

Several decision trees are combined in the potent machine learning algorithm Random Forest to increase prediction accuracy. When compared to Decision Trees, it works well with complex datasets, effectively handles missing data, and is less prone to overfitting.

Algorithm	Accuracy score in percentage
DecisionTree	100%(overfitted)
KNN	75%
Naive Bayes	100%
SVM	85%
Random Forest	95%

Comparison of various models





the above figure shows confusion matrix of prediction by random forest classifier.

5. Project Management

Gantt Chart:-

Progress:

The initial stages of the project include group formation and ideation, which are critical for laying the foundation for our project. Our team has spent ample time brainstorming ideas and developing a plan for the application, which is reflected in the duration of these tasks. The application’s idea was briefly discussed and then everyone agreed on the idea of a crop recommendation application. On further discussion we want our app to be more helpful for farmers , so we added features for crop price and fertilizer recommendation.

The designing stage involves designing the user interface and experience of the application, using Figma followed by user feedback and evaluation. The frontend development follows this stage, which involves developing the application's frontend using Flutter.

Now , here comes the building of the machine learning models , for which we have collected the data from kaggle. The machine learning models are developed and deployed efficiently, the models are compared and the best model is chosen based on the accuracy of each model. In summary, The systematic and well-organised approach to the project ensures that each stage is completed efficiently, ensuring the project's success.

Task Distribution:

The tasks were divided equally among the group, it can be mentioned in the project report that the project team followed a collaborative approach to execute the project. Our project was divided into three main parts

namely, crop recommendation , crop price and fertilizer recommendation.

Names	Designing	App(Coding)	ML Model
Abdul Ahad	Landing Page, Fertilizer Page	Landing Page,Dashboard	Crop Price and its deployment
Ayan Yezdani	Lab Page	Setting Page	-
Chandan Dhinga	Crop Page , Signup Page	Crop Page and Fertilizer Page	Crop recommendation
Dhruv Goel	Profile Page , Lab Page	Lab Page	Fertilizer recommendation and its deployment
Dhruv Sahgal	Home page	Login/Signup Page	Fertilizer recommendation
Pratyut	Home Page	Home Page, Firebase, weatherApi, LocationApi	Crop recommendation model build and deployment
Siddhant Sharma	Crop page , Setting Page , Login Page	Home Page , Localisation	Model Deployment

Peer to Peer evaluation :

Names	Abdul	Ayan	Chandan	Dhruv Goel	Dhruv Sahagal	Pratyut	Siddhant
Abdul		9	10	10	10	10	10

Ayan	10		10	10	10	10	10
Chandan	10	10		10	10	10	10
Dhruv Goel	10	10	10		10	10	10
Dhruv Sahgal	10	10	10	10		10	10
Pratyut	10	10	10	10	10		10
Siddhant	10	9	10	10	10	10	

Average Score and justification

Names	Average Grade	Justification
Abdul	10	Active Member , fulfilled all his tasks given , maintains good relation with team
Ayan	9.7	fulfilled all his tasks given , maintains

		good relation with team
Chandan	10	Active Member , fulfilled all his tasks given , maintains good relation with team
Dhruv Goel	10	Active Member , fulfilled all his tasks given , maintains good relation with team
Dhruv Sahgal	10	Active member, fulfilled all his tasks given , maintains good relation with team
Pratyut	10	Active Member , fulfilled all his tasks given on or before time , maintains healthy relation with team
Siddhant	10	Active Member , fulfilled all his tasks given , maintains good relation with team

Discussion

We encountered numerous problems and limits while building Agriguru, a crop prediction software, which gave considerable learning opportunities. In this section, we will reflect on our important learnings, evaluate the constraints and obstacles we encountered, and explore the possibilities of future project expansion.

Learnings

1.**Importance of user-centered design**: Agriguru was created with farmers' needs and preferences in mind. For example, we conducted surveys and interviews with farmers as well as our academics to better understand their pain areas and preferences. As a result, we built Agriguru with a clean and user-friendly layout that even users with limited computer background can simply navigate.We were able to produce an app that is intuitive, efficient, and satisfies the demands of our target audience by prioritizing user-centered design.

2. **Machine Learning can be a powerful tool for prediction**: We learned about the power of machine learning algorithms for forecasting agricultural outcomes through our project. Several algorithms were used to identify patterns in data and make predictions based on those patterns.It's worth noting, however, that different machine learning models have varying degrees of accuracy and performance. This demonstrated what potential Machine Learning holds to assist farmers in giving data-driven solutions and improving their Harvest.

3..The advantage of adopting Flutter for our mobile app development, such as its ease of use, quick development time, and cross-platform capabilities enabled us to design a clean , responsive and practical user interface while also smoothly integrating all the machine learning models techniques into the app.

Limitations

1.**Limited Access to NPK Testing**: For its forecasts, the program relies on reliable NPK values obtained through soil testing at neighboring labs. Many farmers, however, do not have access to NPK testing facilities. This reduces the app's prediction accuracy.This constraint can have a substantial impact on the app's prediction accuracy and could impair farmers' produce and profitability.

2.**Difficulty in getting feedback from the target group**:Due to variables such as language hurdles, technology literacy, and availability to reliable communication channels, gathering feedback from farmers on the app's usability and effectiveness may be difficult. This may limit the app's capacity to improve depending on user feedback and may have an influence on its overall efficacy.

3.**Generalizability of predictions**: While the app can predict crop yields based on soil nutrients and climate conditions, other factors (such as pests or disease) that may impact crop yields are not considered. This may limit the forecasts' generalizability to specific geographies or farming practices.

Challenges

1.**Accessing high-quality soil nutrient climate data and market price of crops for all regions**: Obtaining agricultural data can be difficult, especially for areas that are not well-represented in data collection initiatives. Access to correct data for all regions is a constant challenge.To assure data quality and consistency, we collected our data from variety of sources such as governmental organisations and academic institutions, and then employed data cleaning and preprocessing procedures.

2. It was quite difficult to **design a user-friendly interface** for farmers with little technological skills. It was challenging to keep the language of the app as English given that the majority of Indian farmers are illiterate. By including a toggle button that enables users to switch between Hindi and English, the team was able to overcome this difficulty. Before the interface was completed, several design iterations and user testing were carried out.

3.Another difficulty we encountered was **integrating the deployed ML models** with the Flutter app. We spent a lot of time and effort finding out how to smoothly connect our models with the app's programming because we were still learning the Flutter environment.

Future Scope

1.The development of a **hardware-based NPK measuring** tool would enable farmers to assess the NPK content of their soil without the need for pricey laboratory tests. As a result, farmers in remote areas with little access to laboratory testing would have easier access to the app.

2.Including new functions would give farmers a more complete crop management tool, such as the ability to **predict pest and disease** occurrence. To create precise prediction models for illnesses and pests, further study and data gathering would be necessary.

3.For the app to be accessible to all farmers, regardless of their technological skill, it must be made easier to use and more accessible for farmers with little technological proficiency. This can be done by incorporating **user feedbac**k and carrying out user testing to find areas that could use improvement.

4.For farmers in marginalized communities, **collaborating with government or nonprofit organization**s can help by offering resources and support, such as sustainable farming training and education. To create and carry out educational initiatives, this would call for collaboration with these groups.

Conclusion

In conclusion, Agriguru is a helpful software for farmers who wish to make knowledgeable decisions and confidently accomplish their agricultural goals. With accurate projections based on weather and soil conditions, the app's machine learning algorithms and data analytics make crop yield forecasting simple. For farmers, this can result in increased yields and profitability, enabling them to make better choices.

Agriguru gives users access to the best price he/she should earn for his/her harvest in addition to the forecast tool. The app's labs section keeps users informed of the nearest labs where they can have their soil tested. helping people stay informed and make better farming decisions in the agricultural sector. Based on their unique soil and crop circumstances, the app's fertiliser recommendation tool offers users recommendations for the best fertilisers to apply. The crops may grow and yield to their full potential as a result, boosting farmers' earnings.

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The potential impact of technology on agriculture has been highlighted by our experience creating Agriguru. Although there are obstacles and limitations, overcoming these obstacles can have a positive impact on farmers and the agricultural industry. We think that Agriguru has the potential to benefit the farming industry by offering a dependable tool for crop management and selection, which will ultimately result in higher productivity and profitability.

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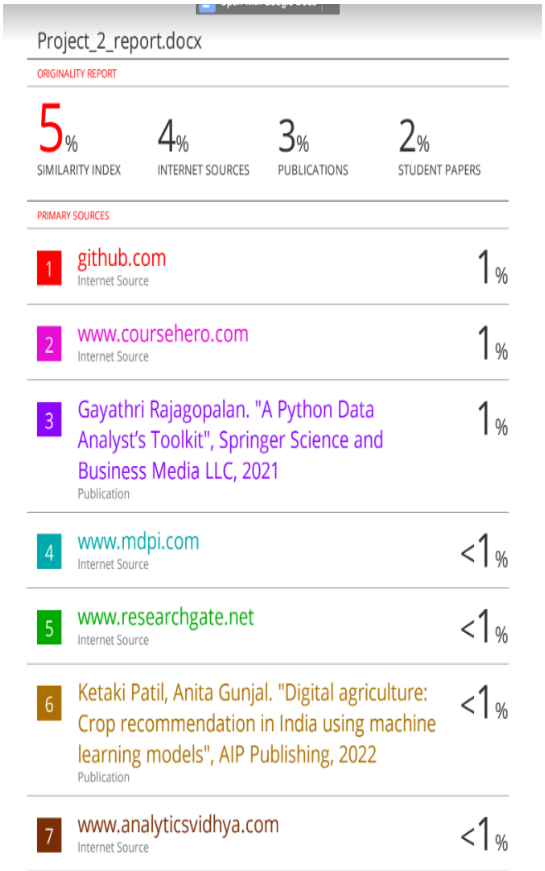

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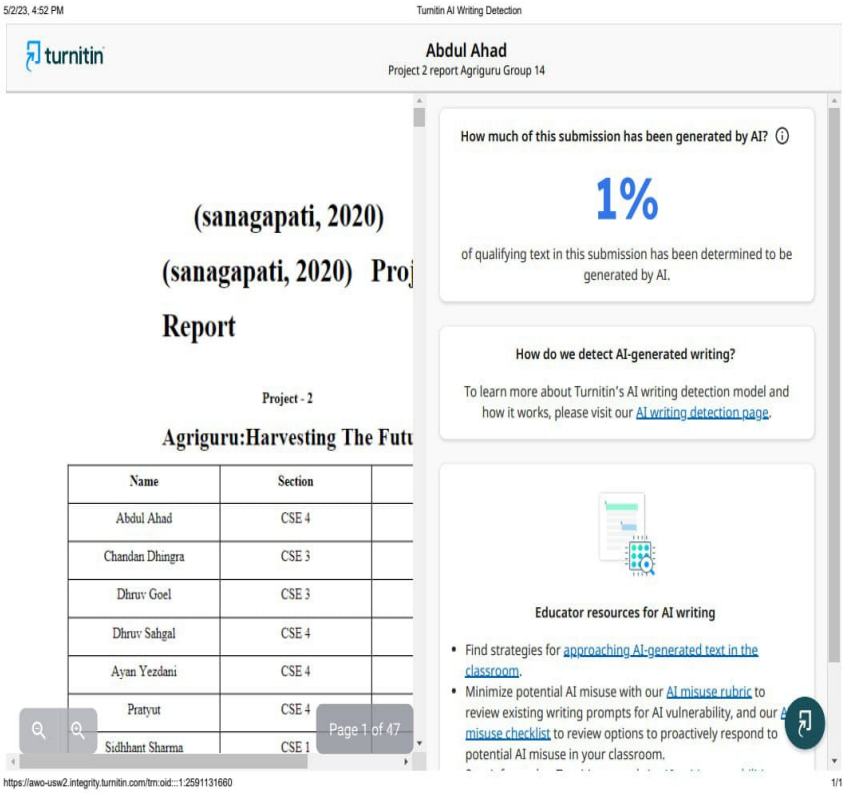

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