Seasonal Crop Recommendation and Retailer Deals

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Abstract

This document explores an approach to improve agricultural productivity success through suitable seasonal crop recommendations and it's process, it gives sheduled seasonal harvesting and specific crop requirements by utilizing localized climate,soil data and irrigation. This recommendations improve crop yield and quality which is profitable to farmers.

Moreover this also focuses on building direct relaton between farmers and retailers for crop agreements and price deals to ensure effective distribution and sales of crops. It gives good strategies for seasonal crop sales by agreements with retailers and setting crop price with mutal deals.

This report mainly focuses on seasonal crop recommendations and building a business model by direct communication between farmers and retailers.

1. Problem Statement

In the filed of agriculture obtaing a successful crop production is so challenging and also analizing market needs is so difficult for farmers. Farmers usually struggles to choose right crop due to unconditional seasons and climate changes and has less idea about crop requirements which leads to unplanned crop production result in loss and wasted resourses.

Although the crop production is good farmers face challenges in selling the crop with best deals, as the mediators between farmers and retailers can only make profit. The lack of direct communication between farmers and retailers and less idea about market needs can results in loss to the farmer as well as retailers as there is no requierd goods. Farmers also face challenges in using right fertilizers and pests, more usage or less usage leads to crop damage, so a proper a guidence should be provided on them too.

This document addresses the challenges faced by farmers and proposing a right plantform for better profitable production:selection of crops through the recommendations and integrating direct partnerships with reatiler can demolish mediators by this farmers make profits through the best deals and agreements with good market needs.

2.Market and Customer Needs Assesment

2.1 Agricultural Market Needs

As the climate changing drastically and soil condition farmers are confused to select the right crop for production , as this demands accurate crop recommendations using the localized weather and soil type and water facility, which increase yield and minimize the risk. Farmers also need to be guided to use accurate fertilizers and water and pests rather than over usage that leads to crop damage and also environment impact. So providing the right recommendation with proper requirements can improve the crop productivity and increase profit to farmers.

2.2 Crop Retailer Needs

As the crop values and needs can change with every season so, retailers also need specific crop at times and they need consistent reliable supply of high quality crops. So with the direct communication with farmers they make deals with farmers for specific needs by this a reatiler can be profitable as well as farmers on understanding the market needs with proper analysis.

2.3 Customer segmentation

The primary customers for this project are farmers and crop reatlers and secondary users will be fertilzer and pest retailers. Farmers make stratgic crop planning through direct communiaction between retailers and make harvesting by their needs. Key customer includes:

- Farmers: Farmers make proper plan through crop recommendations provided to them with utilizing climate and soil type.
- Crop Retailers: The crop retailers who buys from farmers can make direct contact with farmers and make agreements with them for proper needs
- Fertilizer and pest retailers: Crops needs organic and inorganic fertilizers,through connects between farmers and retailers they make good deals with them.

3.Target Specification

3.1 Functionality and Design

Seasonal Crop Recommendations

Utilizing the climate and soil type and water facility data provided by users, app should provide proper crop recommendation and their requirements using machine leaning techniques like clusteing and filtering techniques.

User Friendly Interface

The desing should be simple which can be easily understandable to farmers and retailers, desinging with images can be very helpful.

Notification Facillity

Features like updates on market needs and giving notification for usage of fertilizers and pests can be very helpful to farmers.

Communication Channels

Providing communication channels between retailers and farmers must as they can make direct deals for the crop, as well as proving communiocation channel between farmers and agricultural specialist can also helpful.

3.2 Performance Requirements

Quality recommendations

As the app mainly focuses on the seasonal crop recommendation, It should be accurate with proper requirements which helps to increase yield.

Proper Communication Channels

As the app key feature is to developing communication channels, which leads to many frauds and unknown logins so, maintaing good communication and privacy is very important

3.3 Secuity and privacy policy

The deals and agreements between farmers and retailers should be secure and maintain privacy, which make smooth communications between farmer and retailer throughout crop production

4.External Serach

4.1 Industry Trends and Best Practices

Market Research Reports and Online resources

Agricultural Market Analysis Reports: Utilize the reports over internet such as Marketsandmarkets,mordorintelligence,imarcgroup reports to understand the trends in crop production, consumer preference and market needs.

Soil type and Crop Information: The articles about soil types in nicheagriculture,geopard represent different soil type information and suitable crops grown with detailed explanation

Retailer behaviour studies: Studies on retailer needs and preferences and their choices understood using several studies over internet such as jlobsedujornal, ataripune.icar.gov which gives best case studies.

Climate changes: As the climatic changes the agriculture field needs to be updated choosing right crop the jounals like sciencedirect.com of crop selection as climate change gives good practice to understand the need and recommendation.

Data Set:

Agriculture crop yield dataset from Kaggle:

https://www.kaggle.com/datasets/samuelotiattakorah/agriculture-crop-yield/data

```
In [34]: data = pd.read_csv("crop_yield.csv")
```

```
In [35]: data.head(n=10)
```

Out[35]:

	Region	Soil_Type	Crop	Rainfall_mm	Temperature_Celsius	Fertilizer_Used	Irrigation_Used	Weather_Condition	Days_to_Harvest	Yield_tons_per_hectare
0	West	Sandy	Cotton	897.077239	27.676966	False	True	Cloudy	122	6.555816
1	South	Clay	Rice	992.673282	18.026142	True	True	Rainy	140	8.527341
2	North	Loam	Barley	147.998025	29.794042	False	False	Sunny	106	1.127443
3	North	Sandy	Soybean	986.866331	16.644190	False	True	Rainy	146	6.517573
4	South	Silt	Wheat	730.379174	31.620687	True	True	Cloudy	110	7.248251
5	South	Silt	Soybean	797.471182	37.704974	False	True	Rainy	74	5.898416
6	West	Clay	Wheat	357.902357	31.593431	False	False	Rainy	90	2.652392
7	South	Sandy	Rice	441.131154	30.887107	True	True	Sunny	61	5.829542
8	North	Silt	Wheat	181.587861	26.752729	True	False	Sunny	127	2.943716
9	West	Sandy	Wheat	395.048968	17.646199	False	True	Rainy	140	3.707293

The above data shows agriculture in different soil types ,temperature need and rainfall needed to better production and make profit.

5.Monetization Strategy

5.1 Subsciption and Licensing Models

Premium Recommendations Service

Offer a subscription based service where farmers and crop retailers can access detailed,seasonally optimized crop recommendations and secure communication channels,advanced analytics and personalized planning methodolgies and notifing

Retailer Subscription

Provide a separate subscription for retailers to access market needs and forecasts related crop availability and consumer demand. This helps retailers make informed purchasing decisions and manage their deals and agreements more effectively

5.2 Licensing Agreements

Agricultural software Licensing

Licensing crop management or data analytics to agricultural business and licensing deals and agreements should be properly structured based on needs and numbers

Retailer Partnership Platforms

License platforms that facilitte retailer and farmer partnership and supply chain management to agricultural firms and retailer chains

5.3 Consulting and Advisory Services

Farm Advisory Services

Offer consulting services to farmers on optimizing crop productions,resource management and seasonal planning. This can include guidance of fertilizer and water usage

Retail Strategy Consulting

Provide advisory support to retailers on sourcing strategies, market demand, supply chain management

5.4 Partnerships

Agreements with Agricultural Organizations

Form partenerships with agricultural organizations, research institutions and extension services to offer bundled services.

Retailer Collaborations

Collabarating with retailers to develop exclusive marketing campaigns that leverage the crop production insights provided. Revenue can be shared based on contract terms

5.5 Advertisements

Offer advertising space within the app for fertilizers and pests which useful to farmers. Earn commision on bookings made in the platform

6.Code Implementation

Using the data set some of operations can be performed as below

The below operation give a idea about the data set in terms of soil type and the crop grown in it and amout of temp,rainfall and fertilizers needed:

Data.head() will give first five rows in the data for quicker analysis.

```
In [41]: data = data[['Soil_Type', 'Crop', 'Rainfall_mm', 'Temperature_Celsius',
                      'Fertilizer_Used', 'Irrigation_Used', 'Weather_Condition',
                      'Days_to_Harvest', 'Yield_tons_per_hectare']]
         data.head()
```

Out[41]:

	Soil_Type	Crop	Rainfall_mm	Temperature_Celsius	Fertilizer_Used	Irrigation_Used	Weather_Condition	Days_to_Harvest	Yield_tons_per_hectare
0	Sandy	Cotton	897.077239	27.676966	False	True	Cloudy	122	6.555816
1	Clay	Rice	992.673282	18.026142	True	True	Rainy	140	8.527341
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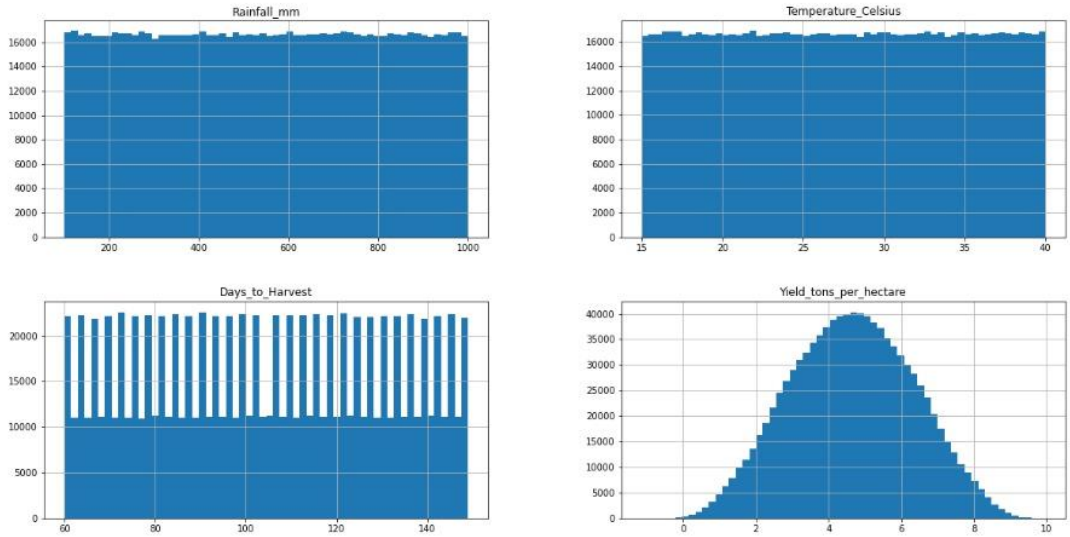
3	Sandy	Soybean	986.866331	16.644190	False	True	Rainy	146	6.517573
4	Silt	Wheat	730.379174	31.620687	True	True	Cloudy	110	7.248251

Histograms

The below operation give information of the histogram analysis as for gopod crop how much amount of temp, rainfall and fertilizers needed

Data.hist() will give histogram analysis

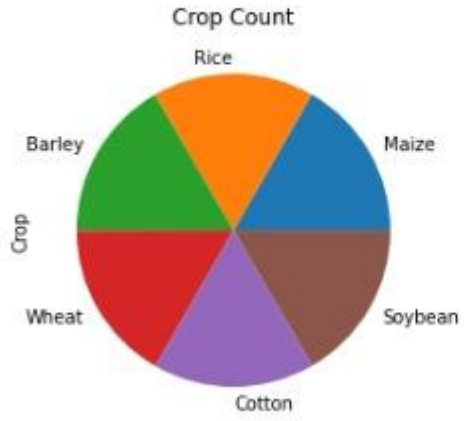
```
In [46]: data.hist(bins=60, figsize =(20,10))
         plt.show()
```



Piechart Analysis:

The below operation give the piechart of crops as we can analyze what crops are grown per tonnes

```
In [47]: ax = data['Crop'].value_counts().plot(kind='pie', title='Crop Count')
         plt.show()
```

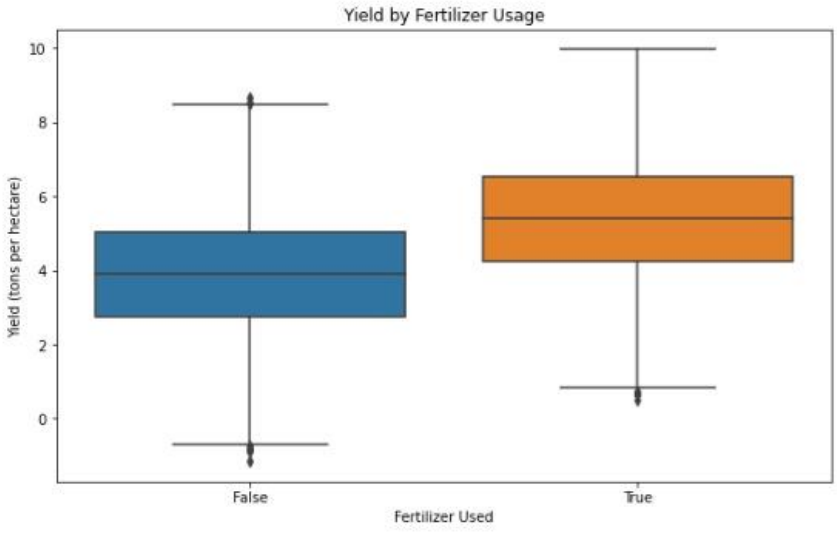


We can observe that all the crops are grown equally throughout India but we has to select better crop for better profit using soil type evaluation.

Usage of Fertilzers

```
In [48]: plt.figure(figsize=(10, 6))
         ax = sns.boxplot(x='Fertilizer_Used', y='Yield_tons_per_hectare', data=data)
         ax.set_title('Yield by Fertilizer Usage')
         ax.set_xlabel('Fertilizer Used')
         ax.set_ylabel('Yield (tons per hectare)')

         plt.show()
```



The above implementation give clear result of usage of fertilizers for the better yield and good profit

For the entire code the github link is mentioned below:

https://github.com/Abhireddy05/Agriculture-data-Analysis

7.Final Product Prototype

The crop recommendations and retailer outreach designed in both ways to give right seasonal recommendation and requirements to farmers as well as build direct connection between farmers and retailers for better crop production. The appliocation aims to provide best recommendations and communication channels which increase agriculture productivity.

Key Features

User profile creation

- Users can create profiles that include name,locality and mobile number and soil type and language for better communication
- Option to upload soil pictures and crop doubts which useful for better recommendations

Safety and Security

- Providing propered liscensing for the deals and agreements can be hlpful which donot give choice to frauds
- Providing helplines can be very helpful as many farmers canot know how to use app properly giving right information at start of login can be very helpful
- The communication between farmer and retailer should be secured and maintain safely

Proper Recommendations

- Providing right seasonal recommendation using data provided such as localized climate, soil type and water facility.

Feedback and Comment

- Users can give feedbacks on recommendations they get and crop production results and they can also give feedback on retailers which increase reatiler value
- Retailers can give feedback based on the deals and agreements made and connections

User Flow

1.Onboarding

- New users download the app from application store and create an account using phnone number
- Farmer users give proper information about locality,soil type,water facility,past crops,and preferences

- Retailer User give information about licensed crop retail shop details, preferences of crops

2.Recommendations

- Using the information provided by the user utilizing those information of locality,soil type and water facility the proper crop recommendations can be given with the requirements

3. Communication Channel

- The proper Communication channels created to develop direct contact between retailers and farmers for the best deals and agreements.

4. Services

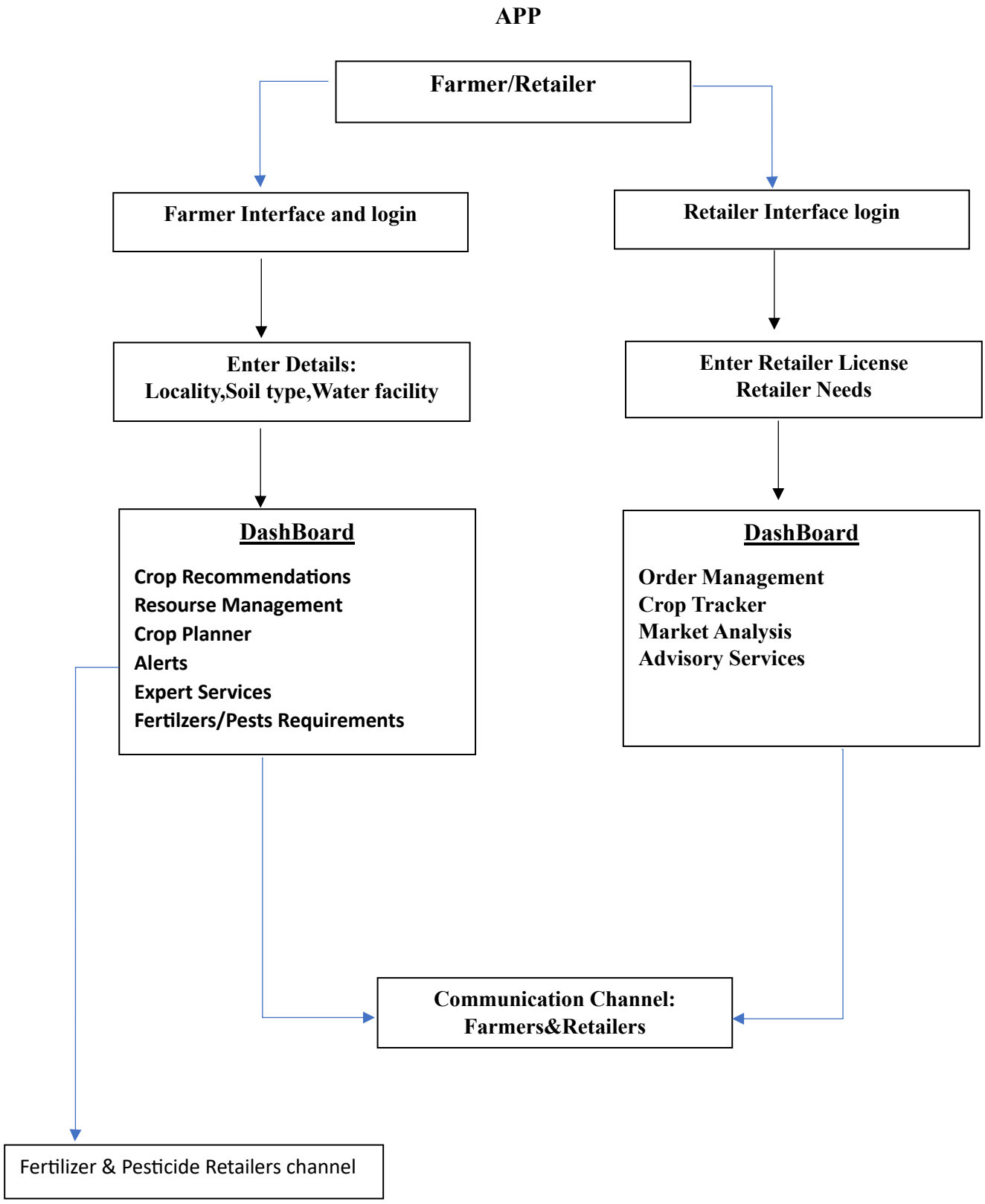
- The services like connecting to the advisory officer and consultants can be provided for proper guidence to yield more and minimize the risk

5. Back-end:

- This involves data collection, pre-processing and integrating the model with the web app.
- The data entered by the customer should also be collected and stored with the customer's permission.

6. Front-end

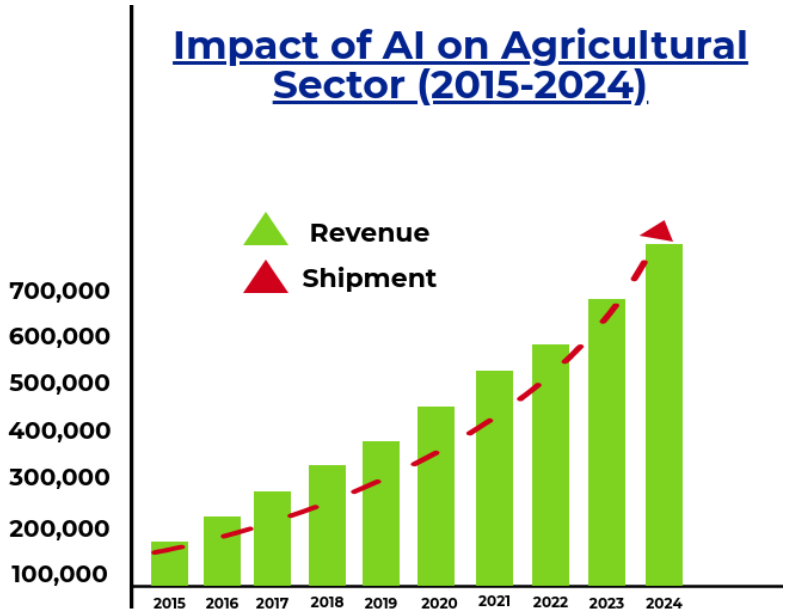
- The frontend contain the login page for user credentials and registraion
- After login or registration user can have two options either crop detection or to connect with retailer
- The respective option opens respective pages these should be user friends and very smooth in away that user can understands easily


APP
Farmer/Retailer
Farmer Interface and login
Retailer Interface login
Enter Details:
Locality,Soil type,Water facility
Enter Retailer License
Retailer Needs
DashBoard
Crop Recommendations
Resourse Management
Crop Planner
Alerts
Expert Services
Fertilzers/Pests Requirements
DashBoard
Order Management
Crop Tracker
Market Analysis
Advisory Services
Communication Channel:
Farmers&Retailers
Fertilizer & Pesticide Retailers channel

8.Conclusion

The seasonal crop recommendation and retailer outreach mainly focuses to give right seasonal crop recommendation and build direct connection between farmers and retailers for selling the crops which increase the agricultural productivity and also lesers the challenges faced by farmers. This app also aims to provide connection between farmers and fertilizer and pecticide retailers as farmers can order for products for right crop.

Financial Equation



The above figure indicates the size of AI impact on the agriculture field from 2015 to 2024.

The revenue and shipment were gradually incresed and made huge impact using Ai and good communiction of farmers and retailers.

These changes not only make profit for the retailers it also show great impact on the agriculture as well as make much profit for farmers by analyzing the crop production by analyzing the need of fertilizer and water for irrigation and the journey of entire crop production.

Let's assume that the duration of developing the ML model takes about 1 to 2 weeks and the cost for producing the model is the salary of the members the team.

Let there be one ML engineers and Two full stack web developer(Works on both FrontEnd and BackEnd)

Let the salary of the ML engineers be 'Salary 1' and the full stack web developer be 'Salary 2'.

Let the subscription of the app include : Rupees: M : 1000

So the total cost : C = Salary 1 + 2*Salary 2. (As 1 ML engeneers and 2 Full stack Developers)

So the profit or financial equation will look like this:

$$y = M*x(t) - C$$

$$y = 1000*x(t) - (\text{Salary } 1 + 2*\text{Salary } 2).$$

Here x(t) is a function that represents the growth of the customer base and y is the profit.