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1. INTRODUCTION

1.1. PROJECT OVERVIEW

Agriculture is important part of everyone’s life but most agricultural crops are affected by a wide range of diseases. This diseases on plants play a major threat to food security and production. Thus, early identification of plant diseases is important to ensure high production and best quality. Over the last few years, the diseases on plants and the harm it causes has increased due to the variation in disease varieties, cultivation methods, and inadequate plant protection techniques. Thus, an automated system is proposed that will be used to identify different diseases on plants by checking the symptoms shown on the leaves and other parts of the plant. Deep learning techniques are used to identify the diseases and suggest the fertilizers that can be used for those diseases.

1.2.PURPOSE

The adequate quantity and quality of fertilizers provide the essential nutrients to the soil for the sustained production of crops.But a fetilizer must be wisely chosen as the plant needs the accurate amount and type of fertilizer.As the agricultural experts are very scarce and expensive, the layman farmers apply the chemical fertilizers with poor technical knowledge.Thus the purpose of the proposed system is to mitigate the lack of experts and assist the rural farmers, with an intelligent machine learning based fertilizer recommendation system.

2. LITERATURE SURVEY

2.1. Existing problem

1. Crop prediction and disease detection system, 2022 - Sambhav Bhansali, Punit Shah, Jinay Shah, Priyal Vyas, Poonam Thakre. Based on the crop and region Vector of farming we will recommend the fertilizer and its uses to boost the Neural yield productivity for farmers. Sometimes due to unwanted excess of rainfall or the pest attack can cause disease to crops. We will use the image classification technique where the user can upload the picture of the affected plant/crop and the system will figure out the type of disease which will be done using Support Vector Machine (SVM) or using the neural network techniques. And this disease detection will suggest that how that plant/crop can be cure or prevent.

Advantages:

The prediction and diagnosing of leaf diseases are depending on the segmentation such as segmenting the healthy tissues from diseased tissues of leaves.

Disadvantages:

This further research is implementing the proposed algorithm with the existing public datasets. Also, various segmentation algorithms can be implemented to improve accuracy. The proposed algorithm can be modified further to identify the disease that affects the various plant organs such as stems and fruits.

Algorithm used:

Support Vector Machine (SVM) or Neural Networks.

2. <u>Fertilizers Recommendation System For Disease Prediction In Tree Leaves, 2020</u> - R.Neela, P.Nithya. Many people lead their life Algorithm from agriculture field, which gives fully related to agricultural products. Plant disease, especially on leaves, is one of the major factors of reductions in both quality and quantity of the food crops. In agricultural aspects, if the plant is affected by leaf disease, then it reduce the growth of the agricultural level. Finding the leaf disease is an important role of agriculture preservation. After pre-processing using a median filter, segmentation is done by Guided Active Contour method and finally, the leaf disease is identified by using Support Vector Machine. The disease-based similarity measure is used for fertilizer recommendation.

Advantages:

The system detects the diseases with 90% accuracy.

Disadvantages:

System only able to detect the disease from a single leaf.

Algorithm used:

Graph cut algorithm

3. <u>Soil based fertilizer recommendation system for crop disease prediction,2021</u>- Dr.P.Pandiselvi, P.Poornima. The proposed system was able to analyse the soil nutrient

type efficiently, kind of leaf disease present disease prediction in the crop and predict the fertilizer in a proficient manner. The approach was flexible, and can be extended to the needs of the users in a better manner.

Advantages:

The system helps to compute the disease severity and recommend suitable fertilizer.

Disadvantages:

The system uses leaf images taken from an online dataset, so cannot implement in real time.

Algorithm used:

Long or short term memory algorithm

2.2. REFERENCES

[1] Crop prediction and disease detection system, 2022 - Sambhav Bhansali, Punit Shah, Jinay Shah, Priyal Vyas, Poonam Thakre.

[2] Fertilizers Recommendation System For Disease Prediction In Tree Leaves, 2020 - R.Neela, P.Nithya.

[3] Soil based fertilizer recommendation system for crop disease prediction,2021 - Dr.P.Pandiselvi, P.Poornima.

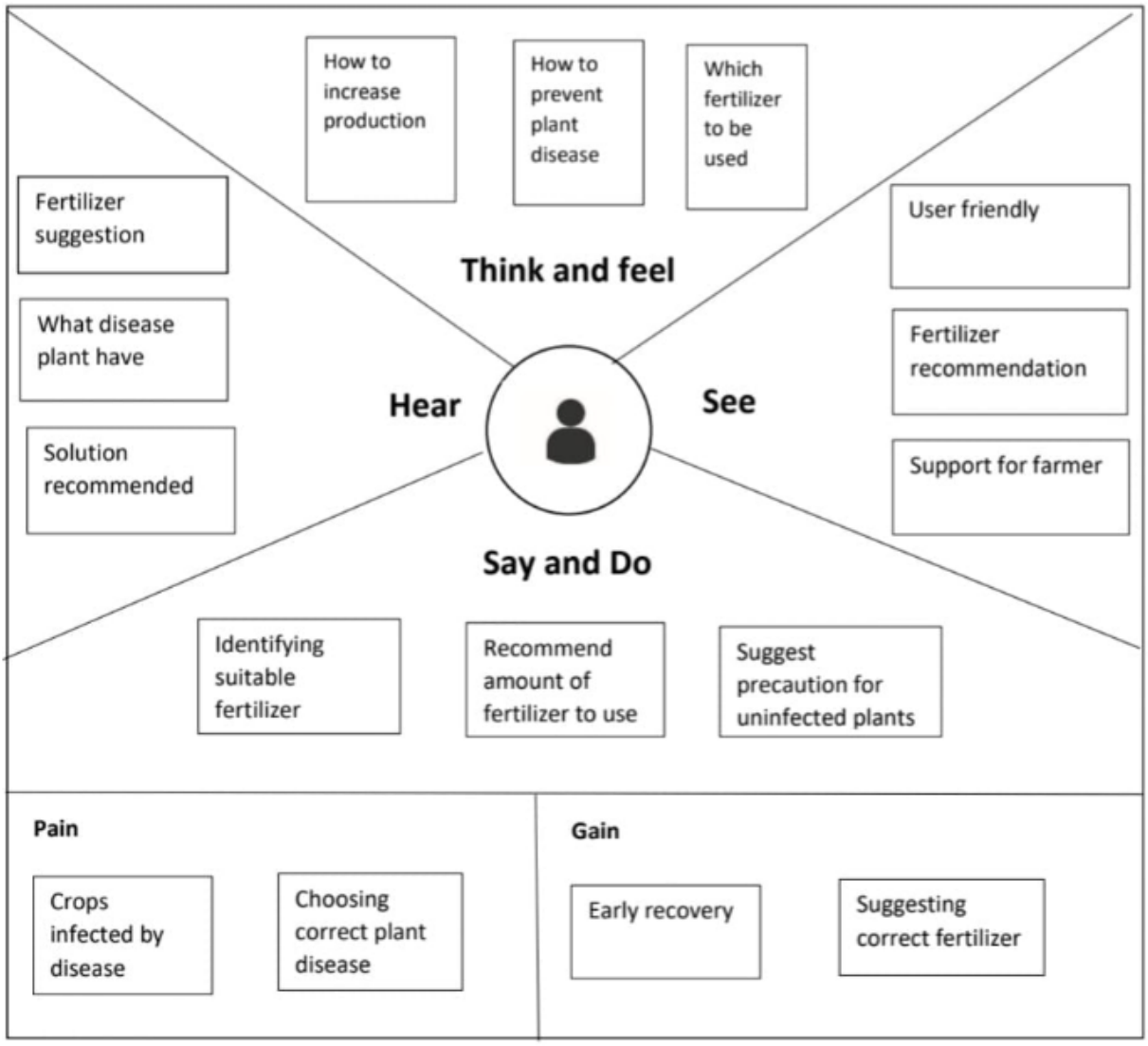
[4] An Overview of the Research on Plant Leaves Disease detection using Image Processing Techniques (researchgate.net)

2.3.PROBLEM STATEMENT DEFINITION

Detection and recognition of plant diseases using machine learning are very efficient in providing symptoms of identifying diseases at its earliest. Plant pathologists can analyze the digital images using digital image processing for diagnosis of plant diseases. Application of computer vision and image processing strategies simply assist farmers in all of the regions of agriculture. Generally, the plant diseases are caused by the abnormal physiological functionalities of plants. Therefore, the characteristic symptoms are generated based on the differentiation between normal physiological functionalities and abnormal physiological functionalities of the plants.Thus, the prediction and diagnosis of leaf diseases are depending on the segmentation such as segmenting the healthy tissues from diseased tissues of leaves will help the farmers find the solution for the disease at earliest and have great yield.

3. IDEATION & PROPOSED SOLUTION

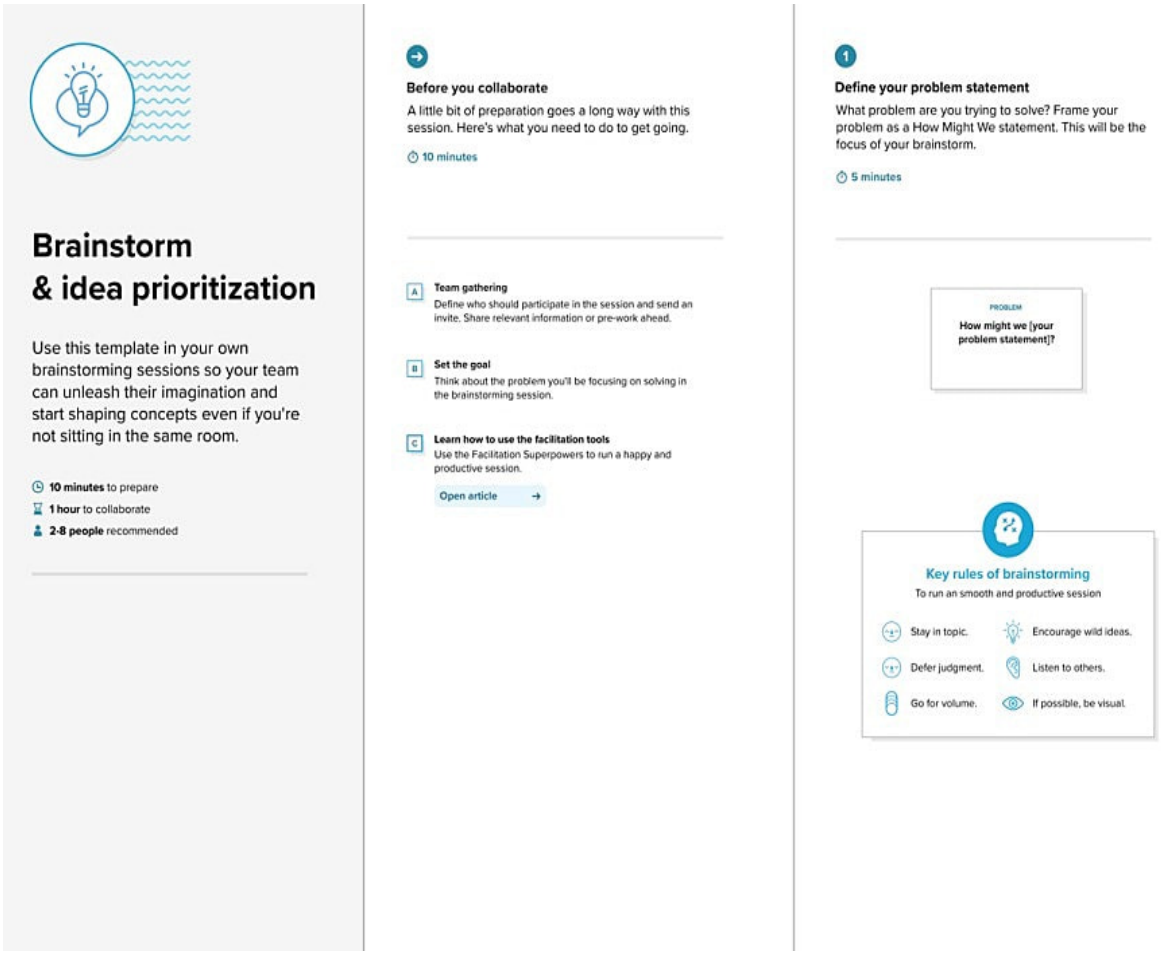
3.1. Empathy Map Canvas



3.2. Ideation & Brainstorming

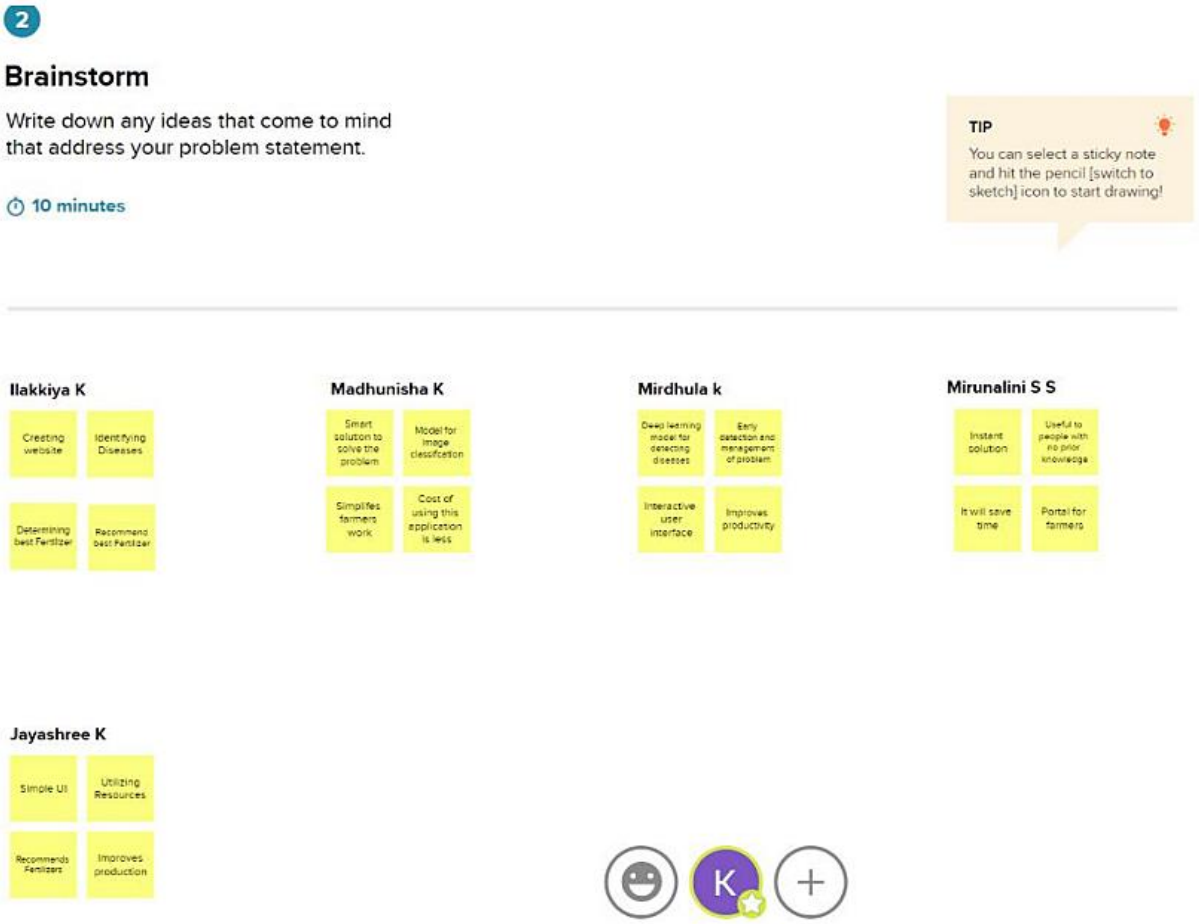
Step-1:

Team Gathering, Collaboration and Select the Problem Statement



Step-2:

Brainstorm, Idea Listing and Grouping



Step-3:

Group ideas

3

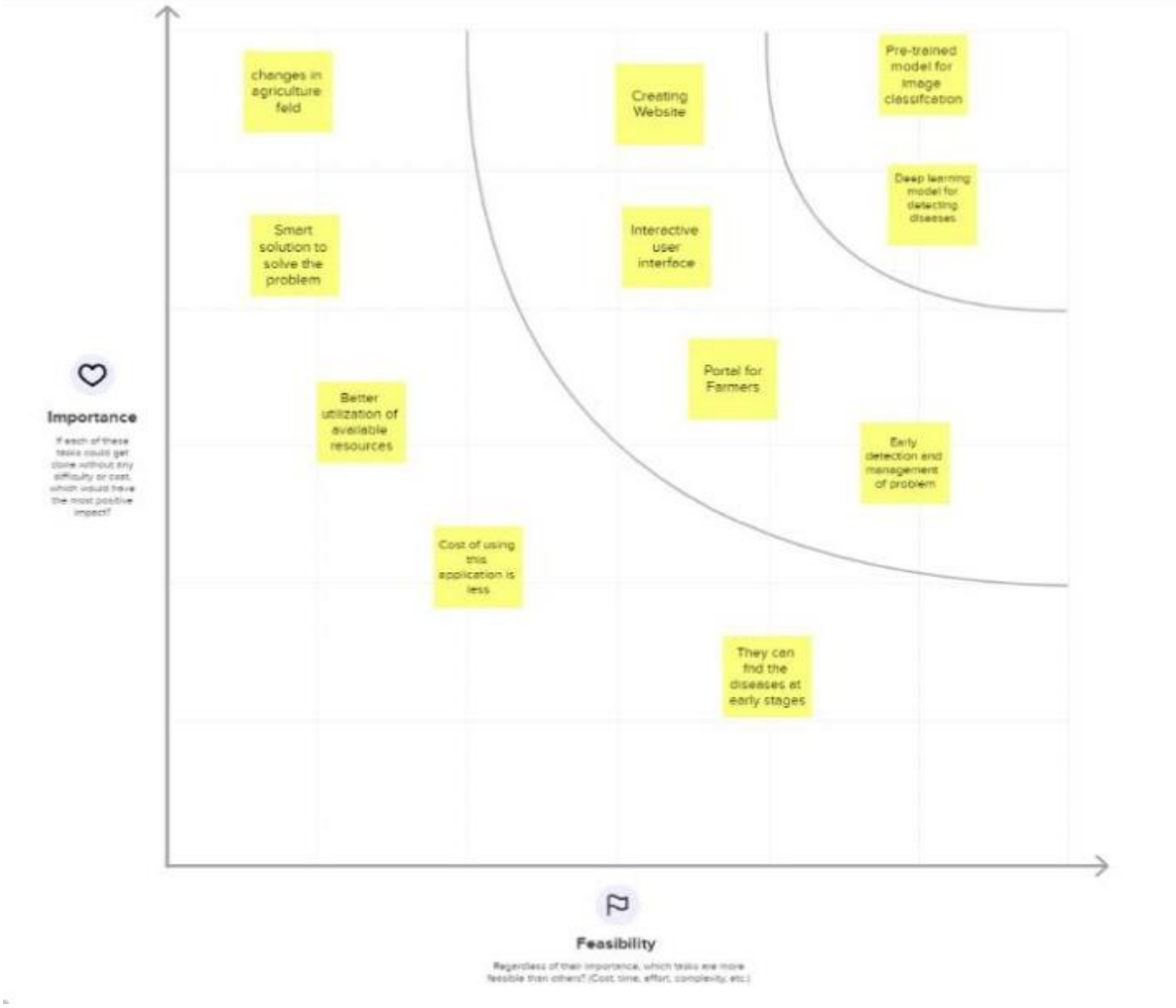
Group ideas

Take turns sharing your ideas while clustering similar or related notes as you go. Once all sticky notes have been grouped, give each cluster a sentence-like label. If a cluster is bigger than six sticky notes, try and see if you and break it up into smaller sub-groups.

20 minutes

Step-4:

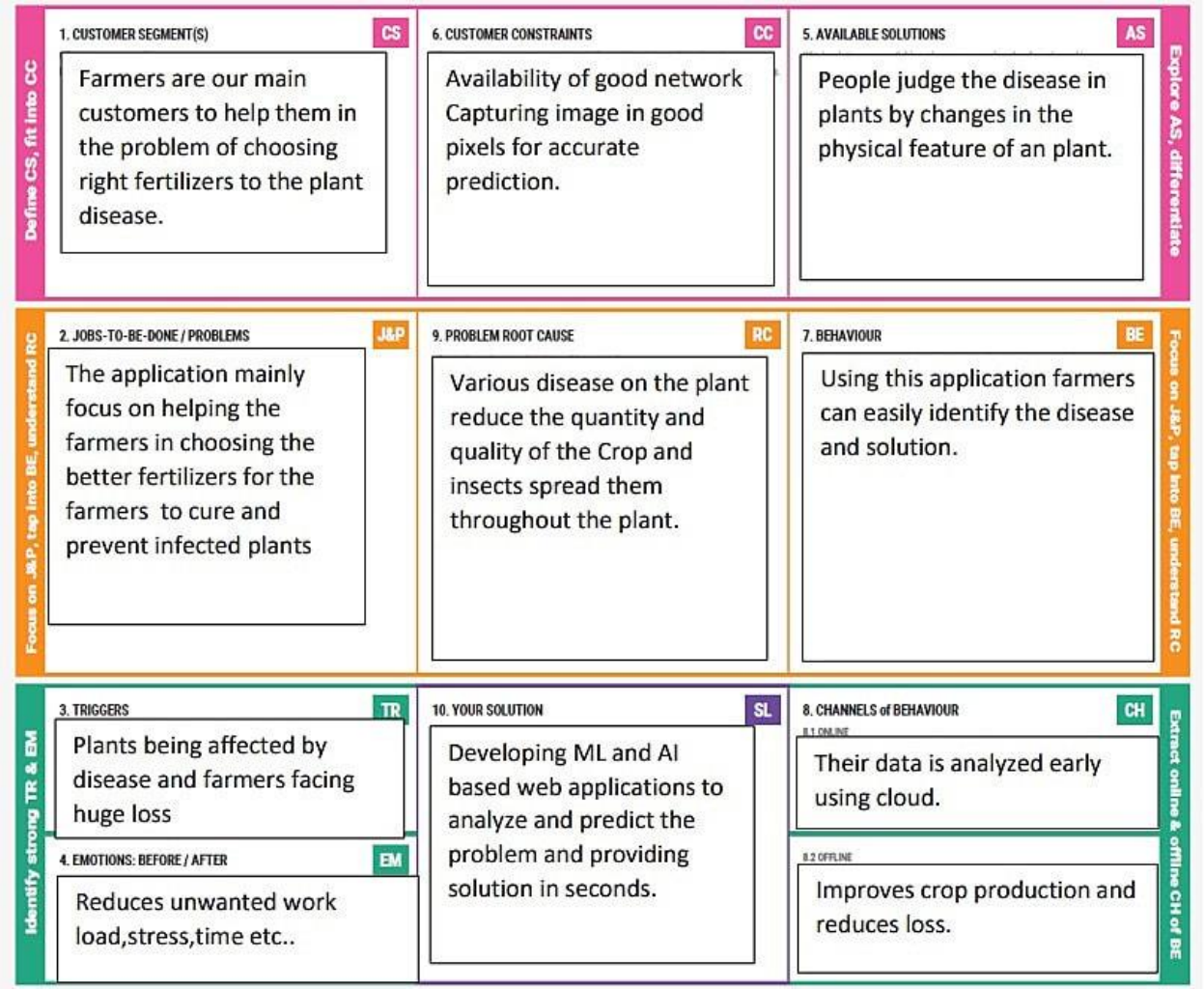
Idea Prioritization



3.3. Proposed Solution

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	Disease in plants will reduce the quality and quantity of the plants productivity. Identifying the disease in plant is a difficult process.
2.	Idea / Solution description	One of the solution to the problem is identifying the disease in it's early stage and recommending the correct solution to prevent and cure disease.
3.	Novelty / Uniqueness	The proposed solution suggests correct fertilizer for the plant disease by recognizing the images using image processing.
4.	Social Impact / Customer Satisfaction	This model helps the farmer by identifying the disease in the early stage and recommends fertilizer to increase the quality and quantity of crops in efficient way.
5.	Business Model (Revenue Model)	The application is recommended to farmer in subscription basis.
6.	Scalability of the Solution	This application can be improved by introducing online purchases of crop fertilizer easily

3.4. Problem Solution fit



4. REQUIREMENT ANALYSIS

4.1 Functional requirement

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Form Registration through Gmail Registration through LinkedIN
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP
FR-3	User Profile	Giving additional information to the profile
FR-4	Uploading Dataset	To upload the leaves of image.
FR-5	Requesting Solution	Uploaded images is compared with predefined model and the solution is generated
FR-6	Downloading Solution	The solution contains the recommendations of fertilizers and the possible diseases.

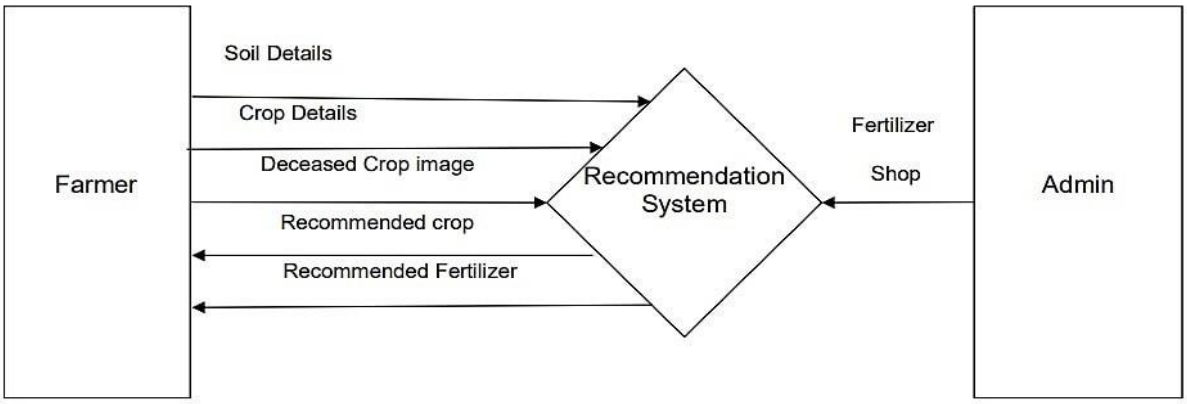
4.2 Non-Functional requirements

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	The system allows the user to perform the tasks easily, effectively and efficiently.
NFR-2	**Security**	Using antivirus software to protect malware attacks or unauthorized attack.
NFR-3	**Reliability**	Single server is running on the application so it take times to recover if any failures occur
NFR-4	**Performance**	Response Time and Net Processing time is fast.
NFR-5	**Availability**	System availability is up to 95% of time.
NFR-6	**Scalability**	The website is scalable.

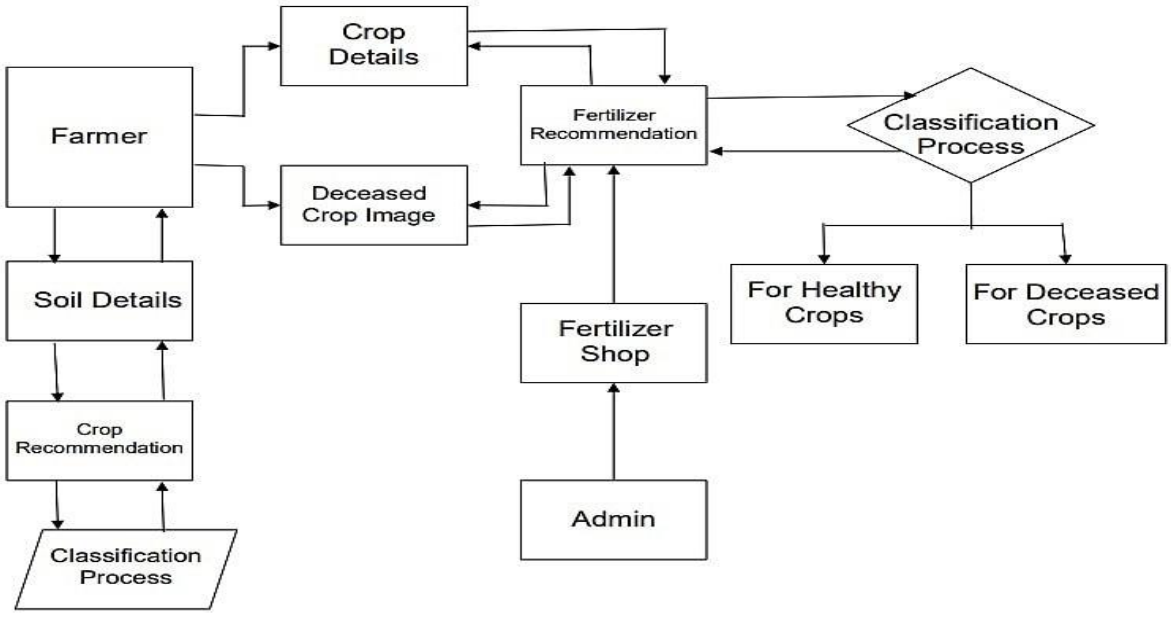
5. PROJECT DESIGN

5.1. Data Flow Diagrams

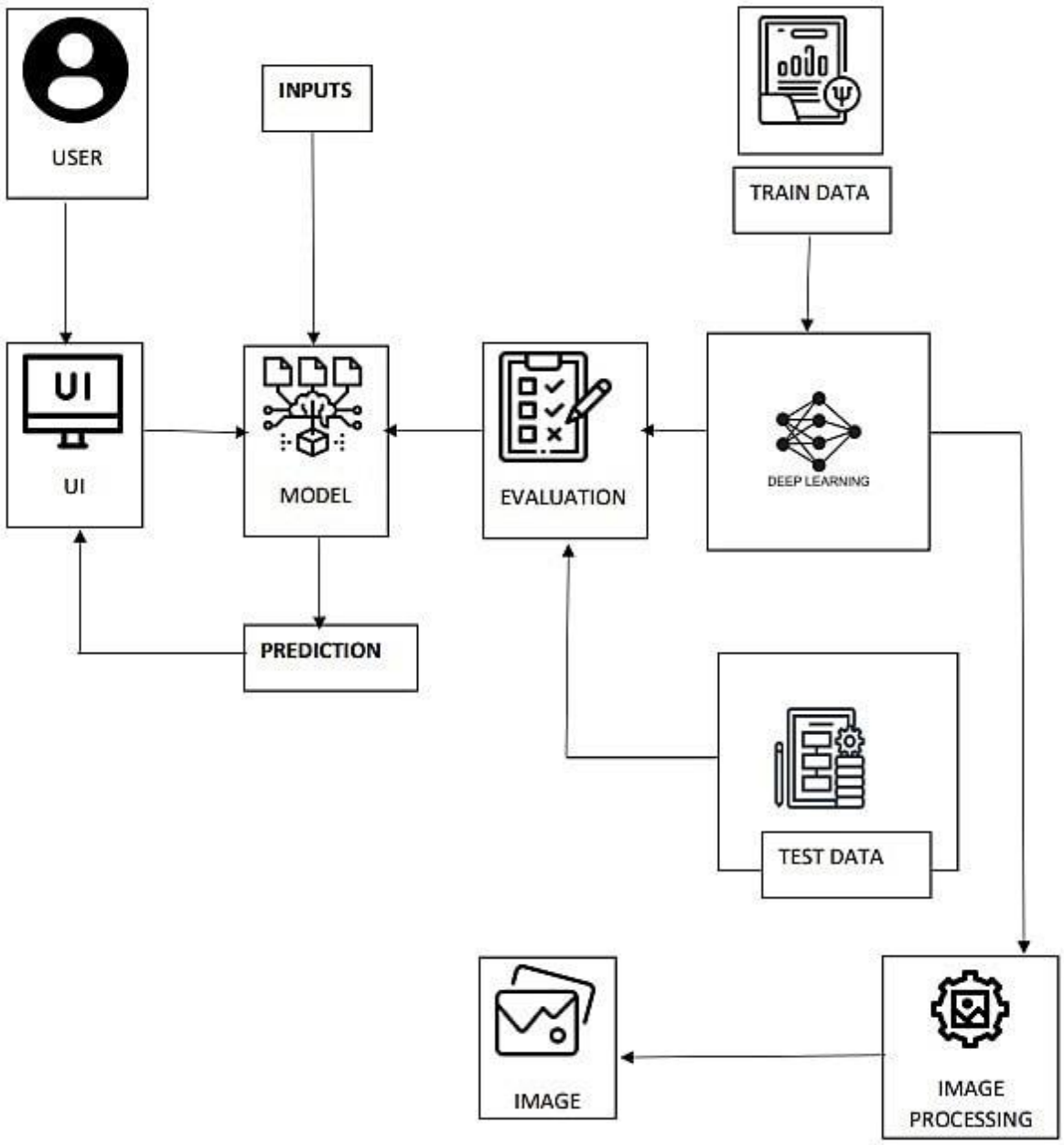
DFD LEVEL - 0



DFD LEVEL - 1



5.2. Solution & Technical Architecture



5.3. User Stories

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Mobile user)	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	I can access my account / dashboard	High	Sprint-1
		USN-2	As a user, I will receive confirmation email once I have registered for the application	I can receive confirmation email & click confirm	High	Sprint-1
		USN-3	As a user, I can register for the application through Gmail other social accounts allowed by the other accounts.	I can access my account/dashboard .	Medium	Sprint-1
	Login	USN-4	As a user, I can log into the application by entering email & password	I can login into account through either mail id or user credentials.	High	Sprint-1
	Dashboard	USN-5	As a user I can view the page to upload plant images to get fertilizer recommendation for the disease	I an access the dashboard of my account.	High	Sprint 2
Customer (Web user)	Registration	USN-6	As a user I can login to the webpage same as logging in the mobile application	I can access my account and dashboard	High	Sprint 3
	Login	USN-7	As a user I can login into the website using user credentials or mail id.	I can access my account and dashboard	High	Sprint 3
	Dashboard	USN-8	It is same as mobile application where I can upload the images to get fertilizer recommendation.	I can access the dashboard.	High	Sprint 3
Administrator	Login	USN-9	As an admin I can login into my account using login credentials.	I can access my dashboard on users information.	Medium	Sprint 2

6 PROJECT PLANNING & SCHEDULING

6.1 Sprint Planning & Estimation

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Registration	USN-1	As a user, I can register by entering my email, password, and confirming my password.	8	High	Ilakkiya K, Madhunisha K, Mirunalini S S, Mirdhula K, Jayashree K
Sprint-1	Pre-processing	USN-2	The data collected is modified to enhance the performance and it is uploaded in the database or IBM cloud.	5	Medium	Ilakkiya K, Madhunisha K, Mirunalini S S, Mirdhula K, Jayashree K
Sprint-2	Analyze	USN-3	The uploaded data are analyzed and it is used to make predictions.	8	Medium	Ilakkiya K, Madhunisha K, Mirunalini S S, Mirdhula K, Jayashree K
Sprint-3	Dashboard	USN-4	The results of previous predictions can be found in the dashboard. I can also view other user details and upload or update images and other details here.	8	Medium	Ilakkiya K, Madhunisha K, Mirunalini S S, Mirdhula K, Jayashree K
Sprint-4	Visualization	USN-5	I can visualize the list of diseases available and their suitable fertilizer.	5	High	Ilakkiya K, Madhunisha K, Mirunalini S S, Mirdhula K, Jayashree K
Sprint-4	Prediction	USN-6	To prevent the plants from getting infected, we can predict the disease and analyze the list for suitable fertilizer.	5	High	Ilakkiya K, Madhunisha K, Mirunalini S S, Mirdhula K, Jayashree K

6.2. Sprint Delivery Schedule

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	13	6 Days	24 Oct 2022	29 Oct 2022	13	30 Oct 2022
Sprint-2	8	6 Days	31 Oct 2022	05 Nov 2022	8	6 Nov 2022
Sprint-3	8	6 Days	07 Nov 2022	12 Nov 2022	8	13 Nov 2022
Sprint-4	10	6 Days	14 Nov 2022	19 Nov 2022	In progress	20 Nov 2022

7. CODING & SOLUTIONING

7.1. Feature 1

The first feature of the proposed system is it detects by which disease the plant is affected by uploading the picture of a leaf in affected plant using image processing.

7.2. Feature 2

The second feature is to help the farmer cure the plant disease by getting correct solution and preventing the plants from further getting affected.In this module after detecting the plant disease the farmer is suggested with which fertilizer to be used and the amount of fertilizer to be sprayed on the farm to get great yield.

8. RESULT

8.1. Performance metrics

Implemented algorithms are checked for performance and accuracy with the help of farmers. Standard precision measure is used for calculating accuracy. Precision is a fraction of the retrieved information that is relevant. It is marked for evaluation of accuracy and exactness. Here accuracy of predicted fertilizers is compared against actual values given by experts for those fields and set of fertilizers for each farmer. If the fertilizer recommended by the system belongs to the expert's recommendations sets then those are suggested.

9. ADVANTAGES & DISADVANTAGES

ADVANTAGES:

It was observed that by using fertilizer according to the recommended dose calculated on the basis of soil test values, farmers could harvest approx. 7-22% higher yield of different crops over usual farmers practice. If this system can be popularized and disseminated by effective agricultural extension, this would immensely contribute to the promotion of precision agriculture, input cost reduction and it would certainly enable us to optimize fertilizer application by the smallholder farmers .

DISADVANTAGES:

The only disadvantage is that everything handled online and everybody cannot get to access internet and smart devices.

10. CONCLUSION

After experimentation, the proposed method is found to perform better and produce a higher number of yields. It is found that a better nutrient amount can be achieved by using the proposed model. If the right amount of fertilizer is applied to crops, then a high yield can be achieved. Using the proposed model, crop yield production increased and gave super ability to decide the right combination of different types of available resources. This will helps farmers and agriculture experts to adopt the method for other crops.

11. FUTURE SCOPE

This further research is implementing the proposed algorithm with the existing public datasets. Also, various segmentation algorithms can be implemented to improve accuracy. The proposed algorithm can be modified further to identify the disease that affects the

various plant organs such as stems and fruits. In the future, we plan to optimize the search strategy and individual repair methods to extract valuable parameters. Furthermore, the AI/ML models or multi-objective optimization models can also be considered to solve the limitation of the optimization issue if there is a suitable model to tune the parameters for further implementation efficiently.

12. APPENDIX

Refer the below github link for source code:

https://github.com/IBM-EPBL/IBM-Project-25324-1659958725