

AWARENESS OF PLANT DISEASES AND THEIR IDENTIFICATION

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Abstract - Every person loves nature irrespective of their age, gender and religion, financial situation etc. Whether planting/gardening is a hobby or daily habit we see plants dying due to lack of several needs. One of them is due to plant diseases. People with no background knowledge on the farming struggle in identifying the diseases because of which their plants died. It is usually taken for granted if a plant dies because we can easily replace them with new ones. But when considered in a large area it is impossible to take plant diseases for granted and Farmers also can't take them for granted.

After some research and surveys, we found it obvious that many people don't have any knowledge of plant diseases even though they have been gardening for a long time. Where some of the diseases are harmful to both plants and humans. So this is a small but one of the problems in this area. This paper is a research which is made on Plant disease identification, lack of awareness in people about them and how to take good care of plants and prevent them from dying. This gives an idea of how to solve this problem. The survey details and referred research paper details are included here. The idea is to make a user-friendly interface that helps the users with no background knowledge on farming to understand plant diseases, spread awareness, detect the disease and also increase the rate of their life to people who surround their lives in gardening/cultivating for food on their own.

Key words: Plant diseases, Agricultural sector, Plants diagnosis, Disease identification, Plant disease awareness.

1. INTRODUCTION

India is an agriculture-based country and about, 70% of the population depends on agriculture. Plant diseases are responsible for major economic losses in the agricultural industry. Disease on plants leads to the reduction in both the quality and quantity of agricultural products and their future growth. Monitoring plant health and detecting diseases at early stages is very much helpful to grow without letting a plant die. These diseases may cause many problems to all living creatures like humans, animals, micro-organisms

which depend on plants will affect their lives. The plants may be affected due to diseases because of fungus, bacteria, etc. Diseases can impact plants in many ways since all parts of a plant can be affected including flowers, leaves, fruits, seeds, stems, branches, and roots. These diseases may impact the nutrients of plants which further affect human life in danger. And, many people do not have awareness of plant diseases that may cause plants to die. So, awareness is most helpful for plants to not die. It may indirectly help living beings to survive.

2. Primary Research

The way followed for getting into more details on this project, the research questions, data collection and data analysis, and conclusion are provided below. The goal of this research is to have a clear understanding of the present situation of how much people are aware of plant diseases and how they can find the disease. The questionnaire includes the opinions of various people, and their knowledge, interest in small area cultivation or gardening.

Later on, analyzing the survey results, the present articles and journals regarding this issue are studied. After going through different methods, processes, we finalized a few important ones which are better, i.e. having fewer drawbacks, and started thinking of ways to overcome them.

3. Empathize Phase

In this phase 3 different tasks are performed.

3.1 Beginner's mindset

- We with an attitude of openness, eagerness, and lack of preconceptions, just as beginners, and we are interested in gardening.
- As we are unaware of agriculture and farming and are interested in small area cultivation or gardening.
- We thought of gardening and we came with a problem that, after few days of planting, the plants

getting some sort of diseases and we could not able to identify them and could not take necessary precautions and they are dying.

- This is the reason we as a beginner selected the domain as Agriculture and the problem statement as Plant disease unawareness in small area Cultivation/Gardening for people having minimum knowledge in farming.

3.2 Body storm

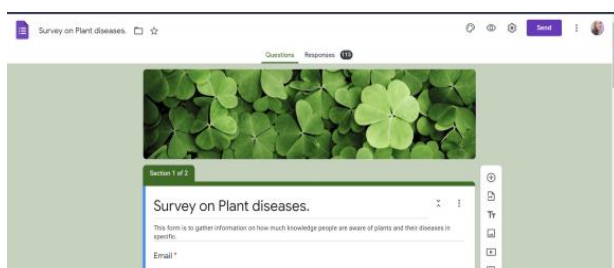
- As said above we are interested in gardening we have planted trees so far and we physically experienced that plants are suffering from diseases for few days which are unknown to us and we are helpless to save our plants.
- As we don't even know the name of the disease, so we are completely helpless regarding the detection of the disease of a plant.
- So we came up with a problem of plant disease unawareness in gardening.

3.3 Empathy Map

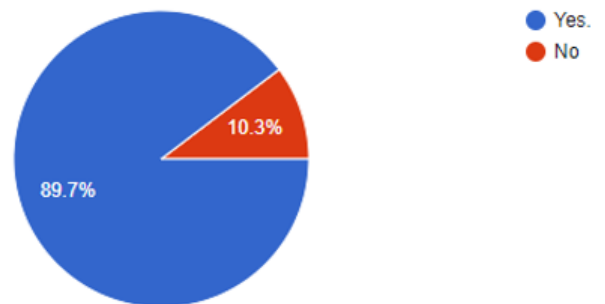
While thinking of gardening or small area cultivation, people will have so many emotions in their mind, as they think about:

- Which sapling to be grown or which crop to be cultivated across their land/garden and how long will they grow.
- Which diseases are to be affected by plants, and how aware people are about that disease?
- They will perform a survey about the duration of growth of plants and diseases affected to them.
- They will hear some suggestions regarding their plants/crops from neighbors, and other people, also they will observe the diseases of plants and precautionary measures. Finally, they will feel a lot of pain when the plant has died due to unaware disease.

4. Primary Survey Questionnaire

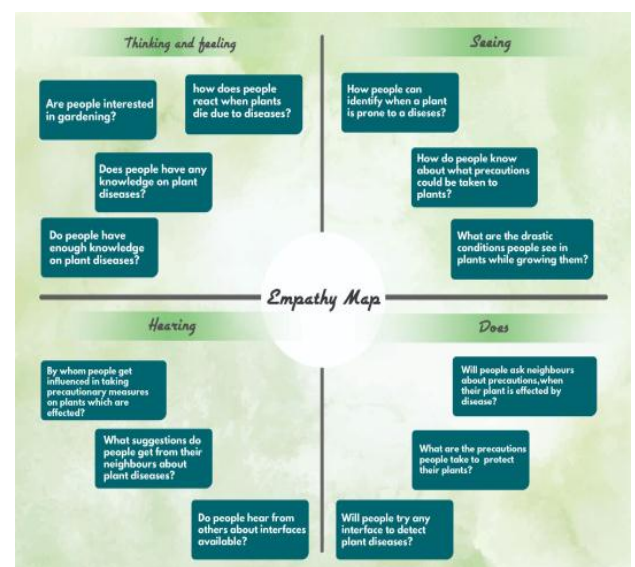


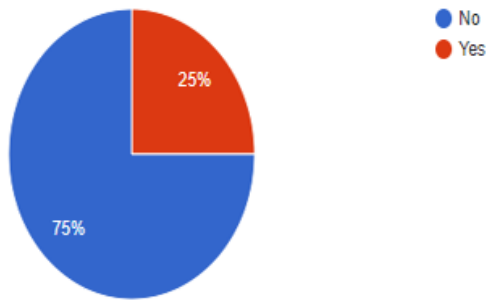
- On enquiring about the knowledge on small area cultivation and awareness on plant diseases, as we have surveyed different age grouped people and we came to know that 90 percent of people are interested in gardening.



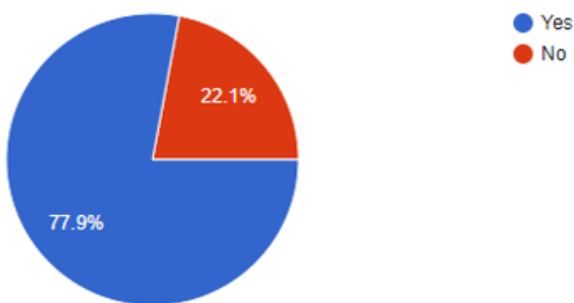
So our survey of the questionnaire has continued as follows:

- On questioning that, "Do they have any knowledge on plant diseases?" Then, we came to know that 75 percent of people are unaware of plant diseases. This clearly shows that people are unaware of plants and their diseases.

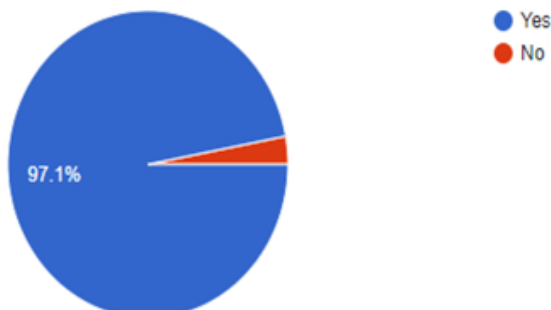




- On questioning about, "Did they find any difficulty to detect a disease of a plant?" Then, we came to know that 77.9 percent of people found difficulty in detecting disease. So, it clearly says that most people are facing problems regarding disease detection.

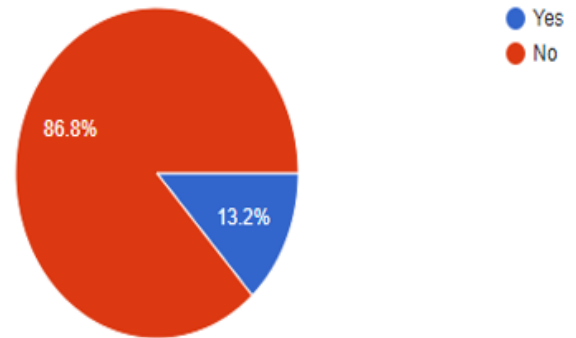


- And next, we started questioning their awareness in the way that, "Do people think that awareness is required on plant diseases?" Then, we observed that 97.1 percent of people said that awareness is required. So we conclude that most people need awareness of plant diseases.

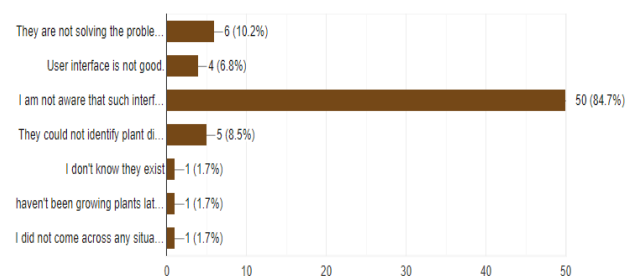


- Also, we questioned, "Did they try using any interface/applications to find/detect plant diseases?" Then, we have received that 86.8 percent

did not try using any applications for detection. So we say that people did not use applications for detection.



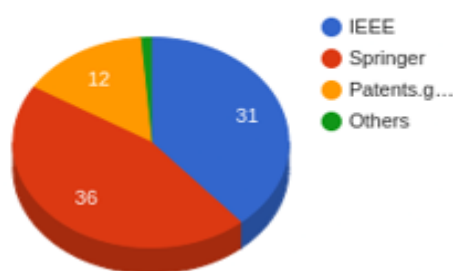
- According to the above question, we have asked them "Why didn't they use any of the applications available?" Then 88.1 per cent of people responded that they are not aware that such interfaces are available, and 10.2 percent people responded that interfaces are not solving the problem efficiently, and 8.5 per cent people responded that the interfaces could not identify plant diseases related to their plants, and 6.8 percent people responded
- That user interface is not good and a least of people said that they haven't been growing plants lately.



- Also, we asked them, "Did they like to have any interface/application to detect plant diseases?" Then 88.7 per cent of people responded positively that they like to have an interface regarding plant diseases. So we came to know that many people are likely to have an interface.

S.no	Databases	Number of Articles
1	IEEE Xplore	31
2	Springer	36
3	Patents.google.com	12
4	ScienceDirect	1

No. of Relevant Article from different Databases



5.6 Systematic Review Findings:

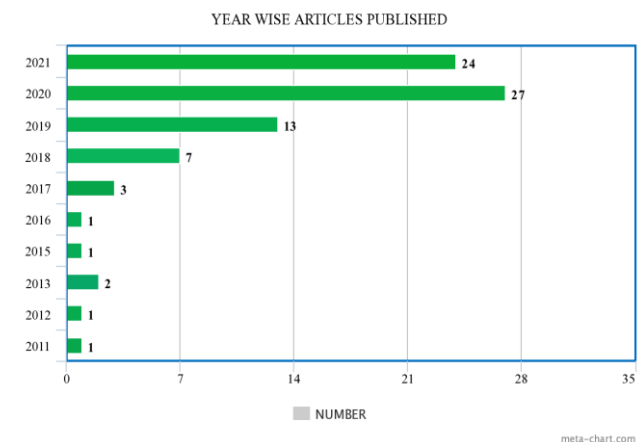
The following table illustrates the number of articles chosen in a particular year.

We have chosen one article each from 2011, 2012, 2015, 2016; two articles each from 2013; three articles from 2017; seven articles from 2018; thirteen articles from 2019; 27 articles from 2020 and 24 articles from 2021. So from this, it is obvious that plant diseases and the need for their awareness have become a major problem in recent years.

Below shows the number of articles published in particular year:

Year	Article Count
2011	1
2012	1
2013	2
2015	1
2016	1
2017	3
2018	7
2019	13
2020	27
2021	24

Below shows the graph analysis of year-wise articles published:



5.7 Data Analysis:

The above chart illustrates the year-wise Article distribution. We've chosen some articles from particular years to analyze diseases of plants and how to detect them and also how to make people aware.

Below we have chosen the years 2021 and 2020 years particularly as we found more relevant articles from those.

In the year 2021, 24 articles were chosen and some of them describe the classification of crop/plant diseases and detection of diseases using image processing. We've examined some articles which were published in 2020 and the articles elucidate disease feature extraction and plant disease detection using 3D deep learning. One of the articles says that the Classification and identification of plants are helpful for people to effectively understand and protect plants. The leaves of plants are the most important recognition organs. With the development of artificial intelligence and machine vision technology, plant leaf recognition technology based on image analysis is used to improve the knowledge of plant classification and protection. An article from 2018 Machine learning-based plant disease detection. Later on, in different years, there were also many articles which said about the diagnosis of plant diseases and image processing based detection and also saving a plant from diseases leads to food security.

5.8 Discussion:

- From the articles related to plant disease detection and awareness, it is observed that many plants are dying due to diseases for many years and it is necessary to save a plant by taking the necessary precautions.
- Also, deaths of plants may further cause lots of loss regarding the environment and also people. In

recent articles, we also observed that early recognition of citrus diseases is important for preventing crop losses and employing timely disease control measures in farms. Employing machine learning-based approaches, such as deep learning for accurate detection of multiple citrus diseases is challenging due to the limited availability of labelled diseased samples. Further, a lightweight architecture with low computational complexity is required to perform citrus disease classification on resource-constrained devices, such as mobile phones.

- Controlling diseases of plants and making people aware of plant disease is very much helpful for people who are interested in cultivation and also who are in need of cultivation.

5.9 Conclusion of Secondary Survey:

- In light of the results of secondary research, it can be concluded that despite having few ways to detect a plant disease, there is no appropriate method in which the process can be implemented in an efficient way.
- Also, there is no awareness among people about these plant diseases and their precautionary measures. Introducing technology in this practice saves plants/crops on a large scale and helps to get on with the further steps in an easy way.
- So, with the help of technology, the plant can be saved, and also people will be aware of these plants and their diseases and how to save plants in a trouble-free manner.

6. Define Phase

In this Point of View, the actionable problem statement was articulated for further design and also to satisfy the needs and insights which we came to know in both primary and secondary research.

The main problem observed and concluded from the primary research is that people are growing plants in their interest which is a very good thing but they are facing issues with plant/crop deaths due to some sort of diseases and people are completely not aware of plant diseases and they cannot take any precautionary measures. Also, people are unaware of interfaces that are helpful to them and some are aware, but that interface is not reaching their expectations and could not solve the problem regarding plant diseases.

The problem statement aims to create awareness among people about plant diseases and detect diseases with ease. With this device, one can create bite-sized knowledge about

plant diseases and also detect the disease of a plant that was affected and can take precautionary measures and can save the plant which further grows healthier.

People are having major issues with diseases of plants/crops while cultivating in a healthy way. They might have a solution by using this device to sort out the issue of plant diseases and make them grow healthier by taking some precautions.

Some questions have been debated after the completion of the research. And those are very broad enough for a wide range of solutions and narrow enough for specific solutions.

The below questions are based on the observations gathered in the Empathize stage:

- How might we come to know that a plant is a disease affected?
- How might we bring awareness among people regarding plant diseases?
- How might we detect a plant disease?
- How might we save plants on a large scale?

On defining the problem statement we came up with a question: why to work out?, And got some abstract statements that are more meaningful but not actionable.

Later on, after many observations, we came up with a question: how to solve a specific problem?

Which took us to the Ideation stage where we started looking for specific innovative solutions.

7. Ideate Phase

To eliminate this problem, some ideas were spawned using tools namely,

- Brainstorming
- Sketch storm.
- 2 x 2 matrix method.

7.1 Brainstorming:

By brainstorming method, in controlled conditions and free-thinking environment, the team has been approached a problem by such means as "How might we" questions

To clearly solve the defined design problem, a vast array of ideas are produced:

- People acquire an awareness of plant diseases:
 - Using visual tools like videos, images.
 - Conducting campaigns on the plants and how to save them.
 - Advertisements and TV shows.

- Magazines, posters.
 - Playlists and podcasts.
 - Running social media contests.
 - Publishing in research papers/journals.
 - Application for creating awareness.
- Preserve/Cure the disease of the plants.
 - Taking plants to the doctor.
 - Using some bitter oils or powders to save plants.
 - Cutting the diseased part of the plant.
 - Designing an application that provides an elite user interface to understand the disease of plants.
 - Exposing plants to heavy sun or heat.
 - Washing the diseased plant with water or cleaning liquid.
 - Replacing the plant with a new one.
 - ML model for detecting the disease from plant image and Image processing for detecting the plant.



7.3 2 X 2 Matrix:

Below mentioned 2 x 2 matrix has been divided into 4 different phases:

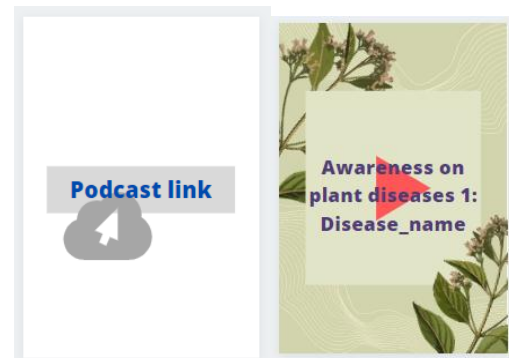
- **Do:** Work out on creating awareness on plant diseases through some ideas and also help the user in identifying the plant diseases easily.
- **Plan:** Some important tasks are to be scheduled and get onto the calendar that when to do and what to do.
- **Delegate:** Many ideas were generated in the phase of ideation, and those are going to be filtered.
- **Eliminate:** Among all the ideas mentioned above some are unrealistic and will be eliminated further.

7.2 Sketch Storm:

- These visuals have a way of provoking further ideas and providing a wider lens of thinking. Below constituted design with sketching out ideas just not to develop beautiful drawings worthy of framing. They are as simple and rough as possible with just enough detail to convey the meaning.
- This tool-assisted to explore design space more fully and avoid the snag of focusing on suboptimal design choices ahead of time. Also helped me to think more openly and creatively about ideas.
- The represented sketch storm is of abundant ideas without worrying about their quality, which is very much useful to invent and explore concepts by being able to record ideas quickly. This made it easier to discuss, critique and share ideas.

DO	PLAN
<ul style="list-style-type: none"> • Creating an application (including subordinate ideas). • Creating playlist or podcast. 	<p>Application, podcasts are two major domains of the ideas.</p> <ul style="list-style-type: none"> - These ideas are prototyped within 2 weeks in a low fidelity prototype method. - Including all the subordinate ideas accordingly in the above major ideas is also in the plan. <p>Implementation takes place further.</p>
DELEGATE	ELIMINATE
<ul style="list-style-type: none"> • Playlist/podcast for awareness. 	<ul style="list-style-type: none"> • Taking plants to the doctor.

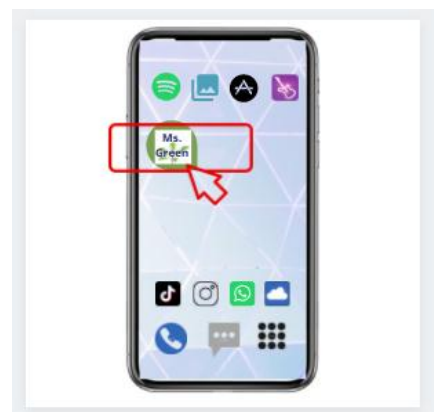
<ul style="list-style-type: none"> • App for plant disease detection. • Notifications with compact information about plant diseases. • Organic or better ways to grow plants. • Image based detection for identifying the plant. • ML model for detecting the disease from plant image and Image processing for detecting the plant. 	<ul style="list-style-type: none"> • Using some bitter oils or powders to save plants. • Cutting the diseased part of the plant. • Exposing plants to heavy sun or heat. • Washing the diseased plant with water or cleansing liquid. • Replacing the plant with a new one. • Running social media contests. • Publishing in research papers/journals. • Application for creating awareness • Using visual tools like videos, images. • Conducting campaigns on the plants and how to save them. • Advertisements and TV shows. • Magazines, posters.
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- **Creating an Application:** An application is created to identify plant disease and provide users with the precautions on how to save plants.

Here low fidelity prototype that is all ideas are represented on a paper:

8.1 Representation of Prototype through pictures:



By selecting the icon named Ms. Green the following screen appears which is of welcoming users and with a camera button:



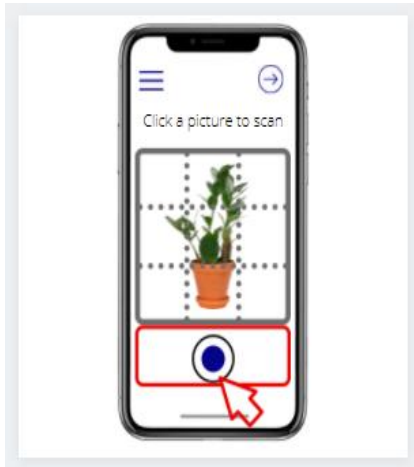
8. Prototype

As many ideas were explored in the ideate phase and some of them are planned to move further for implementation are prototyped as follows:

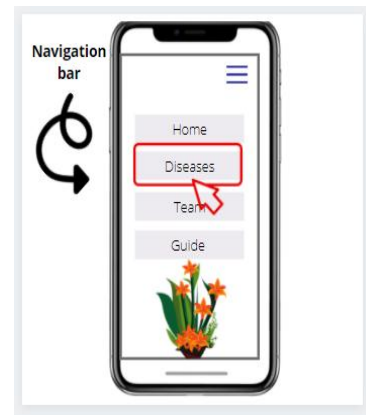
- **Creating a podcast/playlist:** Playlists are to be created in some streaming apps like Spotify, YouTube, to bring awareness among people about plant diseases and precautionary measures to be taken.

These will be weekly episodes based on each case/disease regarding a particle plant topic.

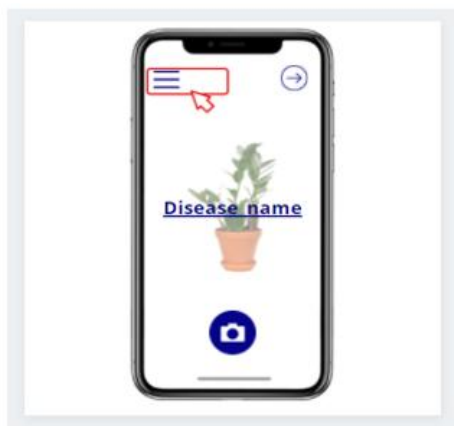
If selected camera, users can take picture of a diseased plant:



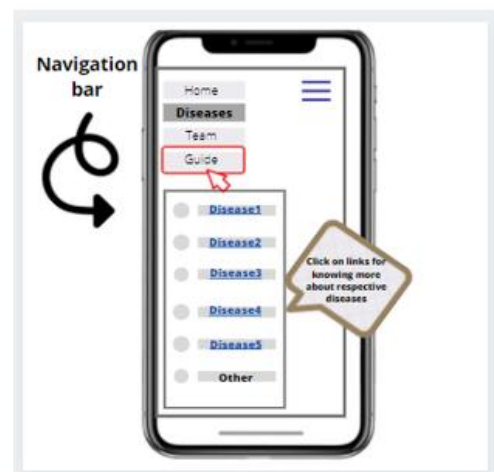
Thereafter selecting the navigation bar users can access some options represented below:



After taking a snapshot, the disease of a plant is identified and the name is displayed as link:



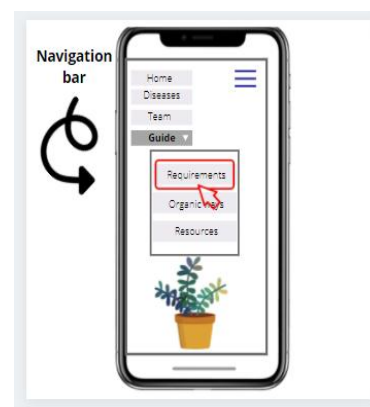
By selecting the DISEASES tab in the options users are provided with some diseases in which they can select a particular disease link which is affected to their plant and will be redirected to the particular link page:



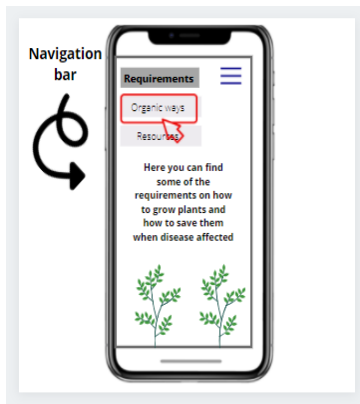
If selected on the link of disease name user can view the precautionary measures:



Thereafter for additional information users can select GUIDE, in this they will find some more options:



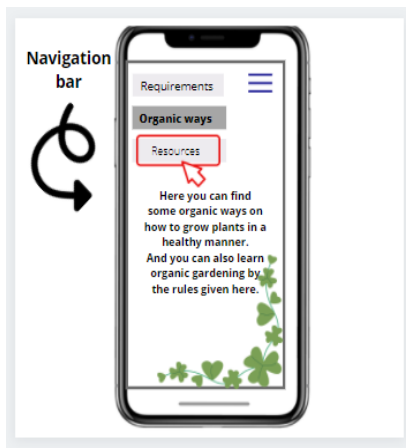
By selecting REQUIREMENTS tab users are provided with some instruction on plants:



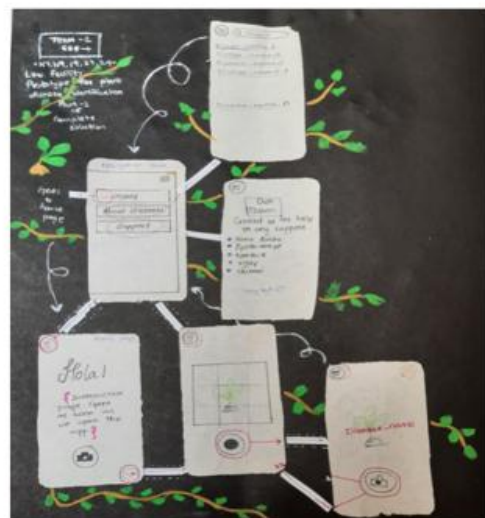
By clicking on the TEAM tab they can contact the developers for any queries or details:



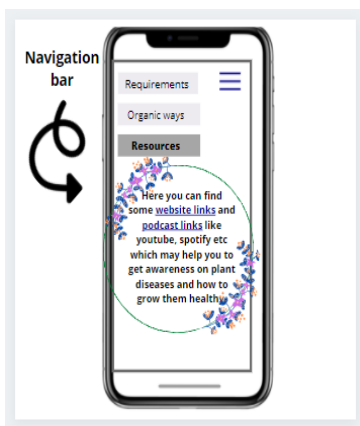
By selecting the ORGANIC WAYS tab users are provided with some ways of growing plants:



8.2 Physical Prototype:



By selecting the RESOURCES tab users are provided with some resource links which help them in getting awareness:



8.3 Tech Stack:

Using a machine learning model is main technical concept used here to detect the disease using the interface.

- After scanning the captured image with image processing. It will be running through a ML.
- While Image processing, It detects some coordinates of the leaf or plant and identifies it is a diseased one or a normal one.
- Upon huge number of inputs, The ML model detects accurately and finds out the diseases leaves and normal ones easily.
- Native React or Flutter can be used to design the app and implement it.

So, tech stack will be:

- Flutter/React
- Open CV
- Training the ML model
- Python
- React JS for UI

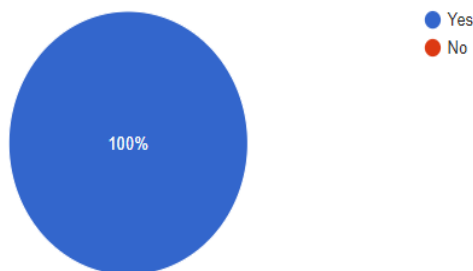
9. Testing



This is undertaken with the prototyping stage, which involves generating user feedback regarding the prototype developed.

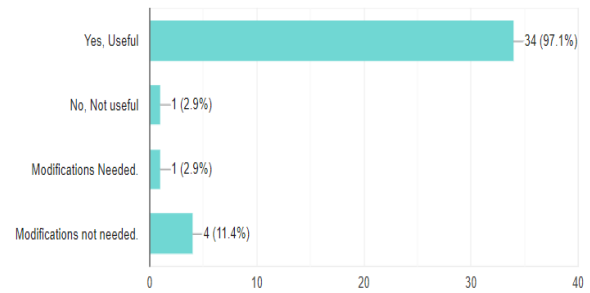
Testing questionnaire for different age grouped people includes:

- Enquiring about creating awareness through weekly podcasts and video playlists can help in developing more knowledge about plants and their diseases among them? Everyone responded positively. This represents that everyone needs awareness about plants and their diseases.



- Further we provided a minute video of our prototype to the users so that they can view that and provide us with their opinions and feedback.

And questioned that, Is the above prototype useful to save plants and do they think any modifications are needed?, Majority of people responded effectively, which is represented as follows.



Finally, we asked regarding their feedback and opinions, and got an efficacious response about the prototype which made us more confident as the feedback shown below:

No suggestions it absolutely fine good job

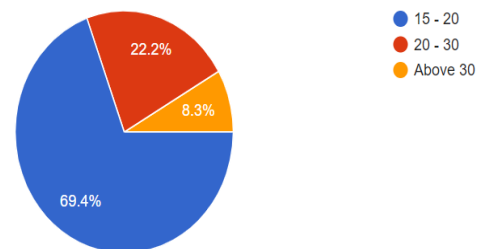
I like the interface and want to use it

Perfect

Cool

Above responses are from these below age groups:

We also thought age might be a factor in deciding the UI/UX of the interface.



10. Conclusion

After performing the vast Empathization which include primary and secondary surveys and generating codebook which gave us better and user needy responses made moved on to define phase where new problems are identified and our problem statement was much precisely re-defined in the point of view of users and several How might we questions helped us a lot.

On defining, we got up with a question: why to work out?, And got some abstract statements that are meaningful.

Later after boundless observations, a question arises on how to solve a specific problem? And the answer took us to the

Ideation stage where we started looking for a wide range of innovative and crazy solutions and come to end with flawless solutions which are:

- Playlist/Podcast to create awareness among people about plant diseases and efficient ways to grow them.
- Simple application with a straightforward user interface to detect plant diseases.

Ultimately we designed the prototype of the above solutions and took feedback from end-users, as we got progressive responses we concluded that these are the best solutions to the defined problem statement.

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BIOGRAPHIES



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