



DEPARTMENT OF INFORMATION SCIENCE AND ENGINEERING

DESIGN THINKING LABORATORY REPORT

(18IS47)

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THEME

“Agricultural Implements”

TITLED

**“Fertilizer Recommendation System
based upon soil quality”**

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RV COLLEGE OF ENGINEERING®, BENGALURU-59
(Autonomous Institution Affiliated to VTU, Belagavi)

DEPARTMENT OF INFORMATION SCIENCE AND ENGINEERING



CERTIFICATE

Certified that the Design thinking Laboratory work titled "**Fertilizer recommendation system**" is carried out by **Ameya Mahadev Gonal (1RV19IS005), Ketan Vaish (1RV19IS023), Sahil Sharma (1RV19IS046) and Harshit Handa (1RV19IS020)** in partial fulfilment for the requirement of degree of **Bachelor of Engineering in Information Science and Engineering** of the Visvesvaraya Technological University, Belagavi during the year 2020-2021. It is certified that all corrections/suggestions indicated for the Internal Assessment have been incorporated in the report.

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Name of Examiners

Signature with Date

1

2

2

ACKNOWLEDGEMENT

Any achievement, be it scholastic or otherwise does not depend solely on the individual efforts but on the guidance, encouragement and cooperation of intellectuals, elders and friends. A number of personalities, in their own capacities have helped me in carrying out this Design Thinking Laboratory work. I would like to take this opportunity to thank them all.

We are thankful to the coordinator, Dr. Anala M.R., Assistant Professor,, Dept. of ISE for her wholehearted support, suggestions and advice during this work

Our sincere thanks to Dr. Sagar B M., Professor and Head, Department of Information Science and Engineering, RVCE for his support and encouragement.

We express sincere gratitude to our beloved Principal, Dr. K. N. Subramanya for his appreciation towards this work.

We thank all the teaching staff and technical staff of the Information Science and Engineering department, RVCE for their help.

ABSTRACT

India is an agrarian nation. But creating a profitable yield for the farmer in each crop cycle is becoming a major challenge on various factors. Picking the reasonable fertilizer for the land and yield is an important and basic part of agriculture.

We all know that soil nutrients and season have a direct impact on the growth and yield of a crop. Deficiency on the nutrient level of the soil may result in plant disease while applying excessive amounts of soil fertilizer on the other hand, may also cause negative results to the development of the crop. Nutrients on the soil also change as the season changes from wet season to dry season. Fertilizer recommendation system involves using models to calculate the needed amount of variety of nutrients during the crop growth by choosing a suitable fertilizer. This venture is extremely valuable to farmers to pick the right fertilizer toward the start of the product cycle and amplify the yield of their crops.

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EMPATHY

In a general sense, empathy is our ability to see the world through other people's eyes, to see what they see, feel what they feel, and experience things as they do. Of course, none of us can fully experience things the way someone else does, but we can attempt to get as close as possible, and we do this by putting aside our own preconceived ideas and choosing to understand the ideas, thoughts, and needs of others instead.

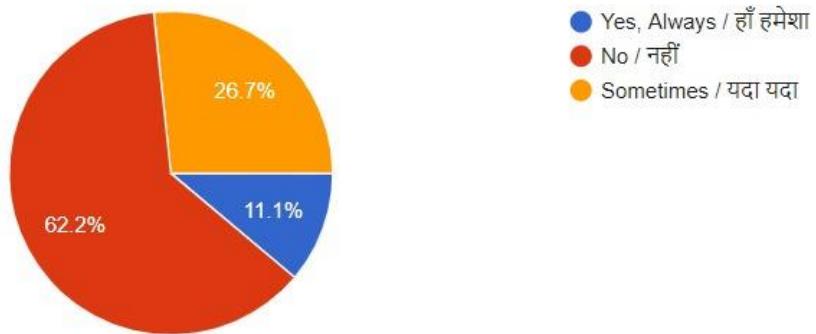
In Design Thinking, empathy is, as explained in IDEO's Human-Centred Design Toolkit, a “deep understanding of the problems and realities of the people you are designing for”. It involves learning about the difficulties people face, as well as uncovering their latent needs and desires in order to explain their behaviours. To do so, we need to have an understanding of the people’s environment, as well as their roles in and interactions with their environment.

Empathy helps us gain a deeper appreciation and understanding of people's emotional and physical needs, and the way they see, understand, and interact with the world around them. It will also help us to understand how all of this has an impact on their lives generally, specifically within the contexts being investigated. Unlike traditional marketing research, empathic research is not concerned with facts about people (such as their weight or the amount of food they eat), but more about their motivations and thoughts (for instance, why they prefer to sit at home watching TV as opposed to going out for a jog). It's inherently subjective, since there is a fair amount of interpretation involved in finding out what people mean rather than what they say.

Questionnaire and Analysis

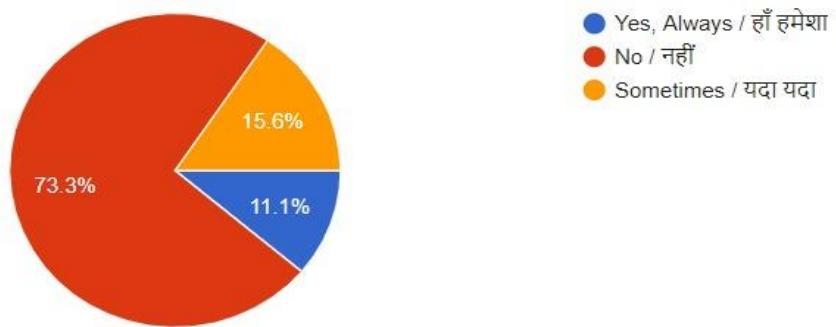
Do you cultivate crops based on your soil quality? / क्या आप अपनी मिट्टी की गुणवत्ता के आधार पर फसलों की खेती करते हैं?

45 responses



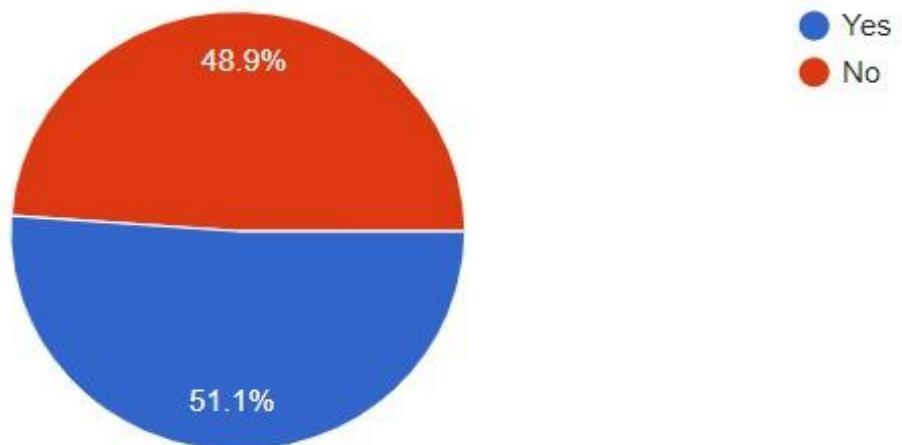
Do you select fertilizers based on your soil quality? / क्या आप अपनी मिट्टी की गुणवत्ता के आधार पर उर्वरकों का चयन करते हैं?

45 responses



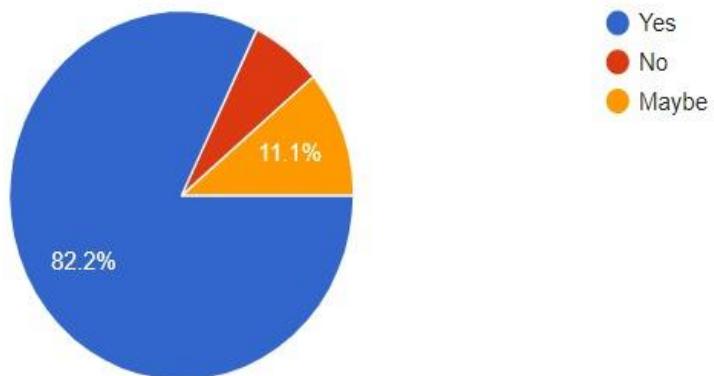
Have you ever got soil tested? / क्या आपने कभी मिट्टी की जांच कराई है?

45 responses



Are you willing to use an application software for selection fertilizer based on your soil quality? / क्या आप अपनी मिट्टी की गुणवत्ता के आधार पर उर्वरक के चयन के लिए एप्लिकेशन सॉफ्टवेयर का उपयोग करने के इच्छुक हैं?

45 responses



Client details

Name	Ruggal Dogra	Satyam Kumar
Area of farm(in ha.)	1 - 3	3-10
Problems faced	Land related issues, Lack of knowledge about fertilizers and Compost	Low yield of the crop, Lack of knowledge about fertilizers and Compost
crops grown	Mustard, Paddy, Wheat	Sugarcane
Ever had a soil test	No	No
Do you cultivate crops based on your soil quality?	No	No
Do you select fertilizers based on your soil quality?	No	Sometimes
Whether the Internet is accessible?	Yes	Yes
Are you willing to use an application software for selecting fertilizer based on your soil quality?	Yes	Yes

Empathy Evidence

Phone Recordings

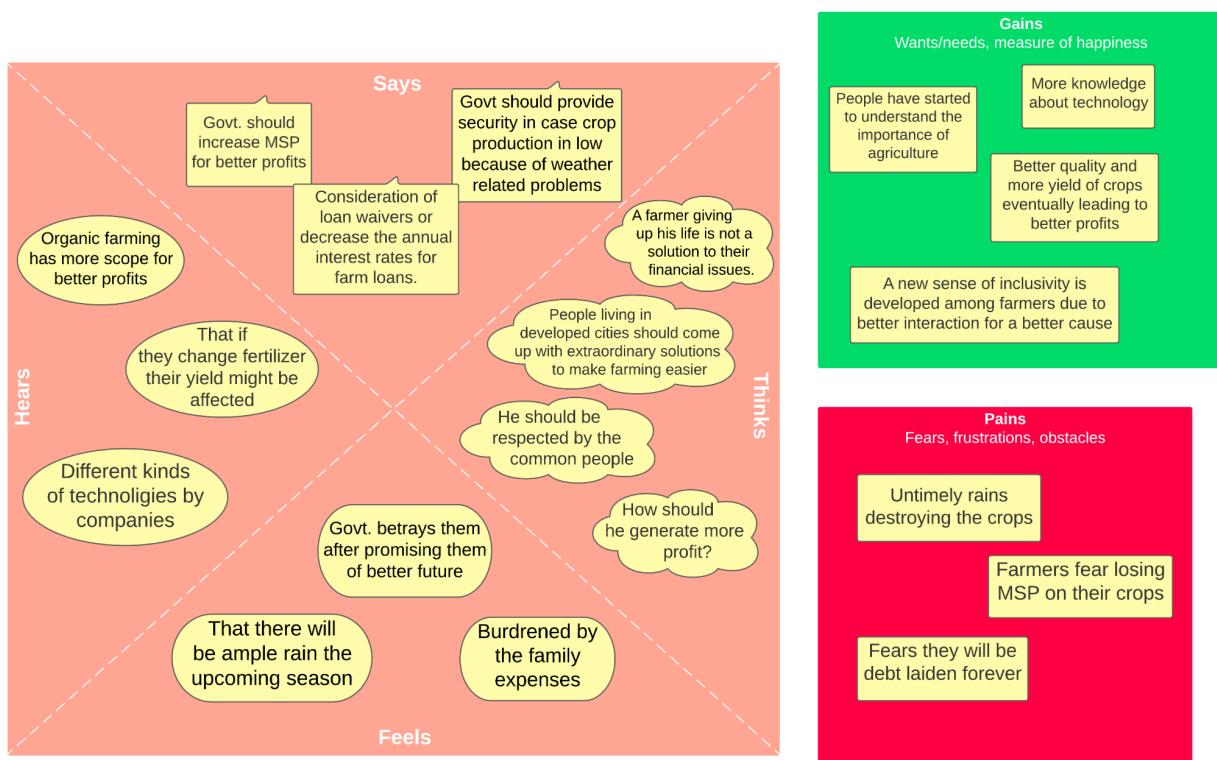
1. [**Recording 1**](#) by Sahil Sharma
2. [**Recording 2**](#) by Ketan Vaish
3. [**Recording 3**](#) by Harshit Handa

DEFINE

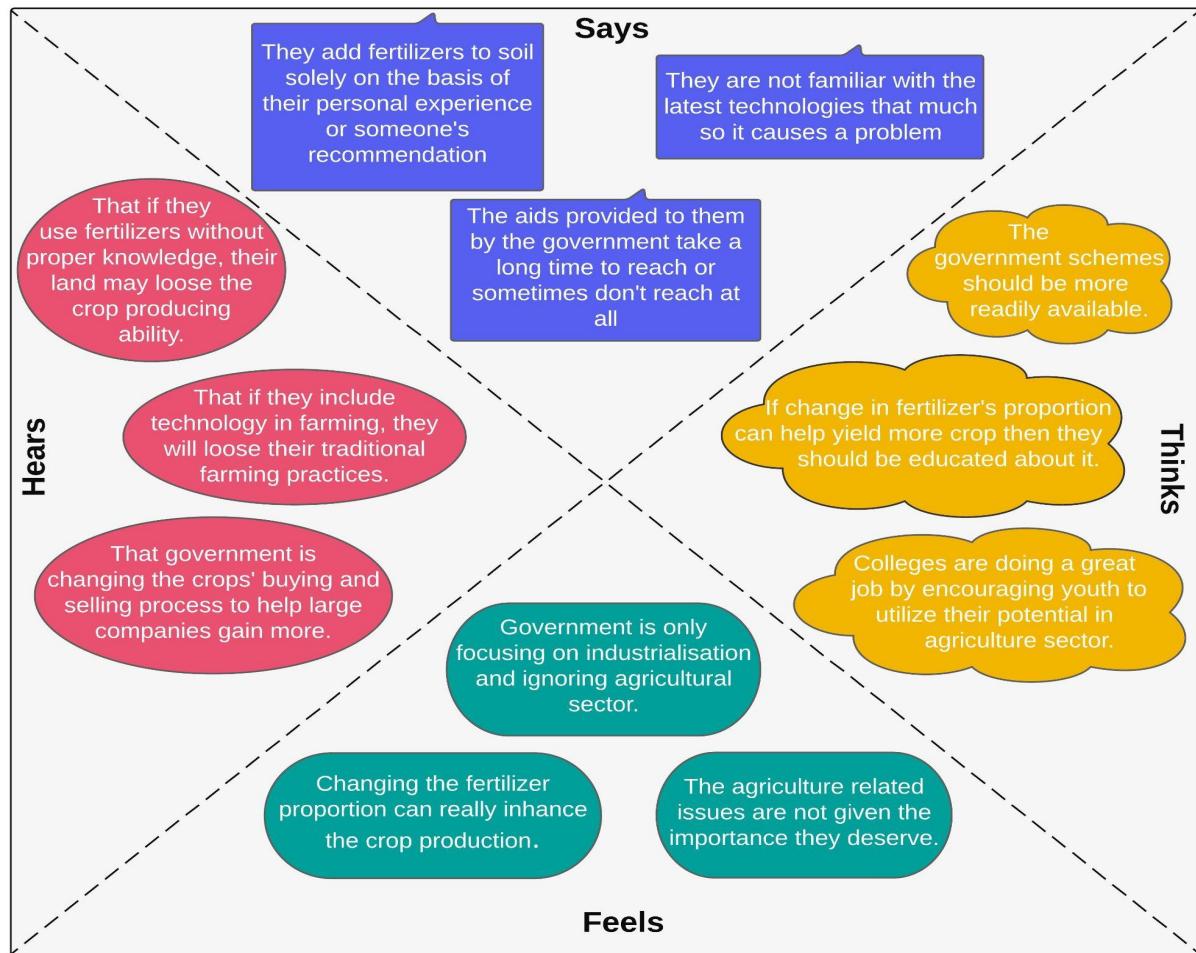
Problem Statement

"Farmers adding fertilizers in the soil without knowing the actual requirements of the soil."

Empathy Map(Generic)

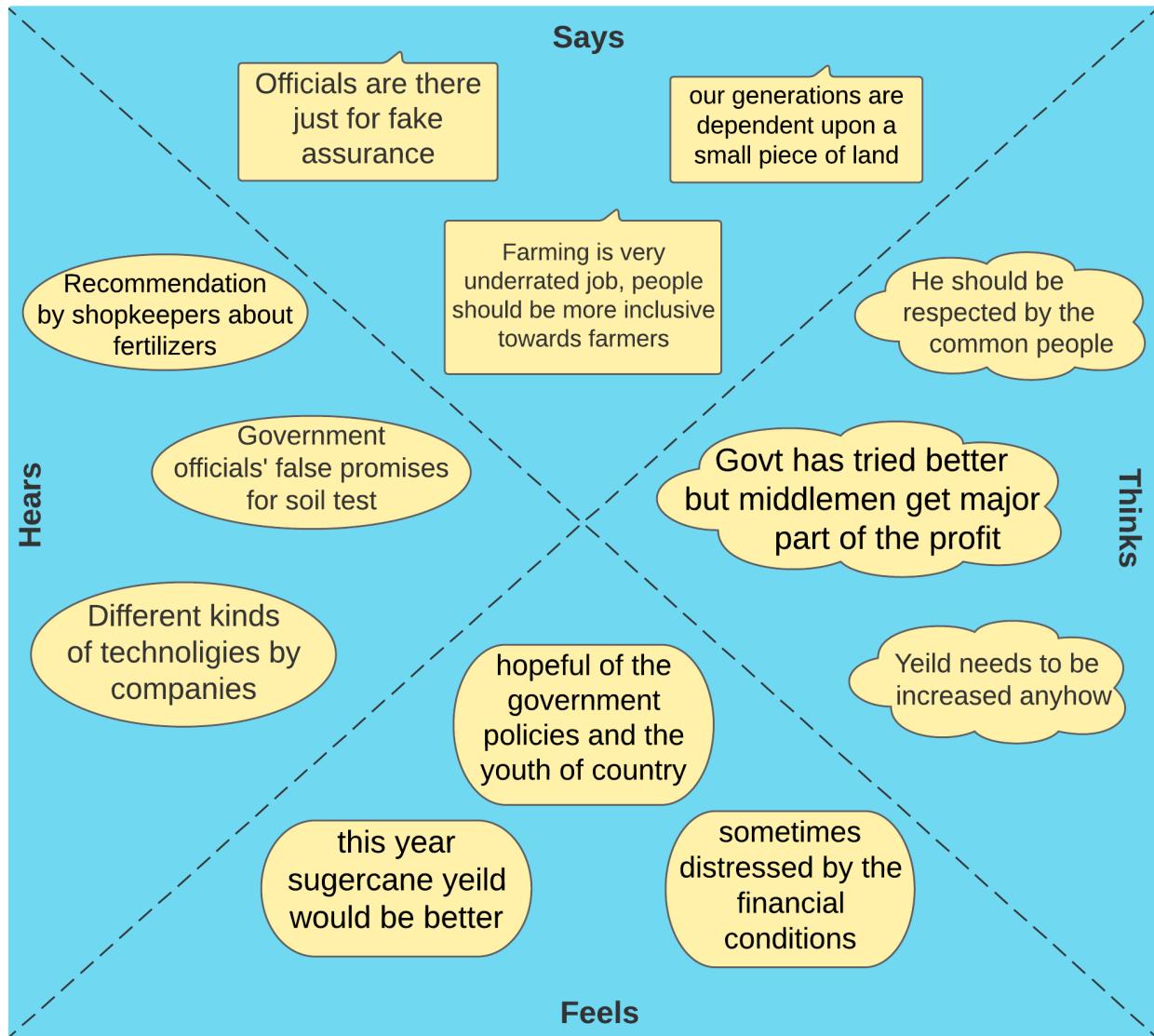


Empathy Map(Specific)



NAME: RUGGAL DOGRA
OCCUPATION: FARMER
REGION: JAMMU

Empathy Map(Specific)



NAME: SATYAM KUMAR
OCCUPATION: FARMER
REGION: SITAPUR, UP

How Might We

- **Educate:**

Many people living in rural areas never encountered the term soil testing, and it is important for them to understand its benefits. We will also encourage them to make use of technology for better yield of crops and be aware about all government schemes and other privileges.

- **Obtain the appropriate data:**

We need the data required for the analysis of the soil test, and on this basis we recommend the most suitable fertilizer. We need to contact universities and agricultural centers, they will provide us with data and guide us to choose the right fertilizer.

- **Approaching Government Agricultural Department:**

We will approach the agriculture department to access soil test data of various regions. If the data is not available, we will request the officials to conduct soil tests and thus, we can use it for analysis and recommendation. We also encourage farmers to get soil of their farmland tested.

- **Testing our UI:**

We will launch the application in a testing phase in which we will seek feedback from farmers to make our user interface as user friendly as possible.

IDEATE

Mind Map



Prime Challenges

1. User interface:

We aim to achieve as user friendly interface as possible, since our end users are farmers who may not be familiar with web technologies.

2. Providing support to farmers(based on locality):

We want to design our UI so as the farmers can approach the government officials who are incharge of these soil tests.

3. Data collection:

Accumulating relevant data for the use of fertilisers for mapping the use of fertilizer based on the soil test.

PROTOTYPE

One of the best ways to gain insights in a Design Thinking process is to carry out some form of prototyping. This method involves producing an early, inexpensive, and scaled down version of the product in order to reveal any problems with the current design. Prototyping offers designers the opportunity to bring their ideas to life, test the practicability of the current design, and to potentially investigate how a sample of users think and feel about a product.

Prototypes are often used in the final testing phase in a Design Thinking process in order to determine how users behave with the prototype, to reveal new solutions to problems, or to find out whether or not the implemented solutions have been successful. The results generated from these tests are then used to redefine one or more of the problems established in the earlier phases of the project, and to build a more robust understanding of the problems users may face when interacting with the product in the intended environment.

Technologies used for prototyping

- After a lot of interaction with the end users (i.e. farmers), we were convinced that a large chunk of the rural population has access to the internet directly or indirectly. Hence, for taking the concerned end users' opinion, we surveyed if the users were ready to use a web portal that incorporates our recommender model.
- We aim to develop a web application for this purpose by making use of the technologies such as:
 - HTML, CSS, JavaScript
 - Django

- Machine Learning Classification Algorithm - Random Forest Classification
- As we proceed with the development part of the project, we will decide about the further technologies, like databases and recommender system details, to incorporate into our system in order to make it more fast, accurate and robust.

Solution Developed

- The prototype is a Machine Learning based model in which the user gives certain input like the percentage composition of nitrogen, potassium in the soil from the soil test report.
- As the input is being given, we'll get the location of the user by using the IP address and then by using the city name we will fetch the temperature and humidity of the area using openweather API. Based on the location and the inputs given, the ML model will recommend the suitable fertilizer.
- Our website also provides information about why soil tests are necessary for fertilizer selection.
- There is an FAQ page as well, where users can get the answers of their most frequently asked questions.
- Website also provides our contact information using which users can contact us and get answers to their queries.
- There are quick links to some of the most useful websites related to soil testing and fertilizers buying options.

Output Screenshots

FERTILIZERS PREDICTION SYSTEM

HOME FERTILIZER RECOMMEND WHY SOIL TEST? FAQ'S ABOUT CONTACT

Click Here for Fertilizer Recommendation

Best Fertilizer Selection

Choose the best fertilizer for your crop and soil out of all the choices available.

Find us

R.V. College of Engineering, Mysore Rd,
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Quick links

Soil Testing labs (State-wise)
Offline fertilizer dealers (State-wise)
Daily Market Price (of various crops)
Buy fertilizers online
Programmes and Schemes
MSP (crop-wise)

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Please fill the details below

Temperature:	<input type="text" value="26"/>
Humidity:	<input type="text" value="77"/>
Moisture:	<input type="text" value="40"/>
Soil type:	<input type="text" value="Loamy"/>
Crop Type:	<input type="text" value="Sugercane"/>
Nitrogen Content:	<input type="text" value="20"/>
Potassium Content:	<input type="text" value="12"/>
Phosphorus Content:	<input type="text" value="0"/>
<input type="button" value="Submit"/>	

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Urea is the recommended fertilizer.

📍 Chandigarh, Chandigarh, IN

(30.7363,76.7884)

Temperature = 26 Humidity = 77

Urea is the most important nitrogenous fertiliser in the country because of its high N content (46%N).

Besides its use in the crops, it is used as a cattle feed supplement to replace a part of protein requirements.

It has also numerous industrial uses notably for production of plastics. Presently all the Urea manufactured in the country is Neen coated.

Urea is a raw material for the manufacture of two main classes of materials: urea-formaldehyde resins and urea-melamine-formaldehyde used in marine plywood.

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About

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About Fertilizer Recommendation System

With The Aim Of Sustainable Crop Production, Reduction In The Misuse Of Fertilizers And Reduction Of Input Cost By Optimizing The Present Pattern Of Excessive Fertilizer Application, Our Team Provides Fertilizer Recommendation Through Both The Manual And Soil Test Based Interpretation Of Plant Nutrients Through Soil Database And Static Laboratory Soil Analysis.

Our Team Has Developed Web-Based Software Named Fertilizer Recommendation System(FRS). The System Is Capable Of Generating Fertilizer Recommendations For Selected Crops By Analysing The Soil Database Developed.

The Software Requires Proportion Of Nutrients In Soil, Land Type, And Crop Type And Variety Information To Generate Crop-Specific Instant Fertilizer Recommendation.

Our Team

Ketan Vaish

Leader

2nd year student in ISE department of R.V. College of Engineering.



Ameya Mahadev Gonal

Member

2nd year student in ISE department of R.V. College of Engineering.



Sahil Sharma

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2nd year student in ISE department of R.V. College of Engineering.



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H: Monday - Friday: 9:00 AM to 5:00 PM

Send us a Message

Full Name:

Phone Number:

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TESTING

Testing is a fundamental part of a UX designer's role. User testing allows designers to gain inspiration, overcome their biases, and be guided. Testing provides necessary evidence of intuition and helps designers to alter products and services where required.

User testing refers to the method used in the design thinking process which evaluates the product, feature or prototype with an end user.

User testing gives you incredibly useful and valuable insights from your users regarding why and how they will use your product. You'll be able to better understand who your users really are and what they want to achieve through using your product.

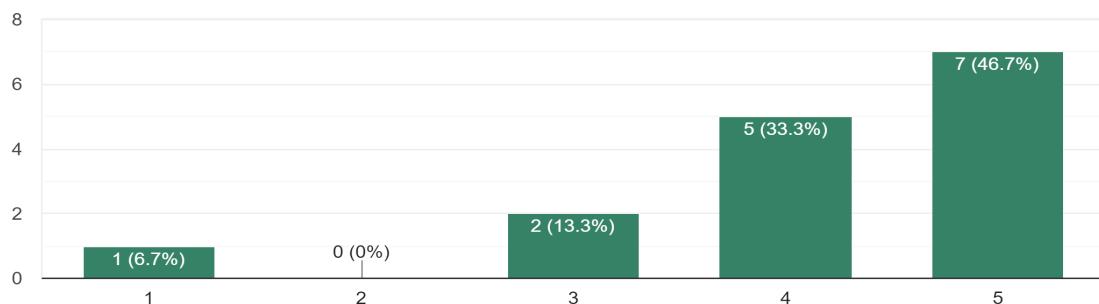
Testing the Prototype is about validating your assumptions and most critical hypothesis, and what worked and what didn't and then iterate. 5th stage of Design Thinking Process- Test stage revolves around User Interactions. In the Test stage the understanding is not just limited to asking if they like a solution or not.

Testing Details & Client Feedback

After testing the prototype by the team and getting various feedback from our mentor we deployed the prototype on Heroku(link given as QR code on the first page as well as on the poster), and procured the feedback through google forms. Given below is the data from the feedback forms.

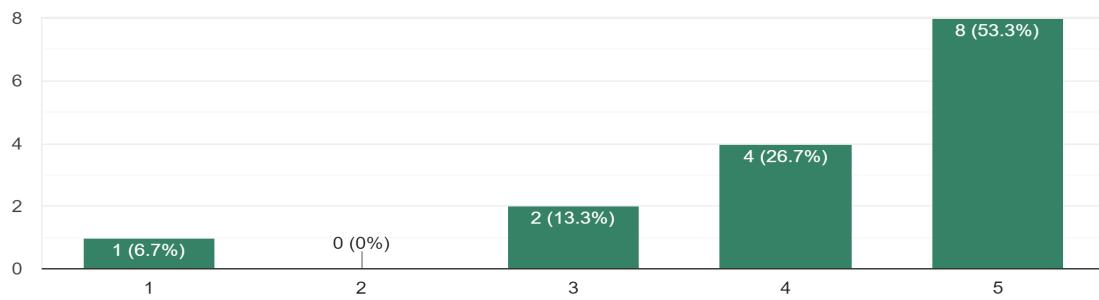
How accurate do you think the recommendations are?

15 responses



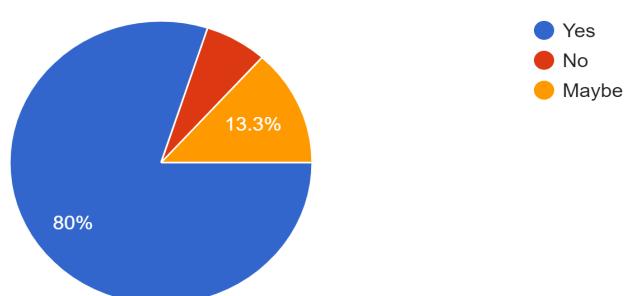
How would you rate overall experience with our application

15 responses



Are you willing to use this application software for selection fertilizer based on your soil quality? / क्या आप अपनी मिट्टी की गुणवत्ता के आधार पर उर्वरक के चय... लिए एप्लिकेशन सॉफ्टवेयर का उपयोग करने के इच्छक हैं?

15 responses



CONCLUSION AND FUTURE SCOPE

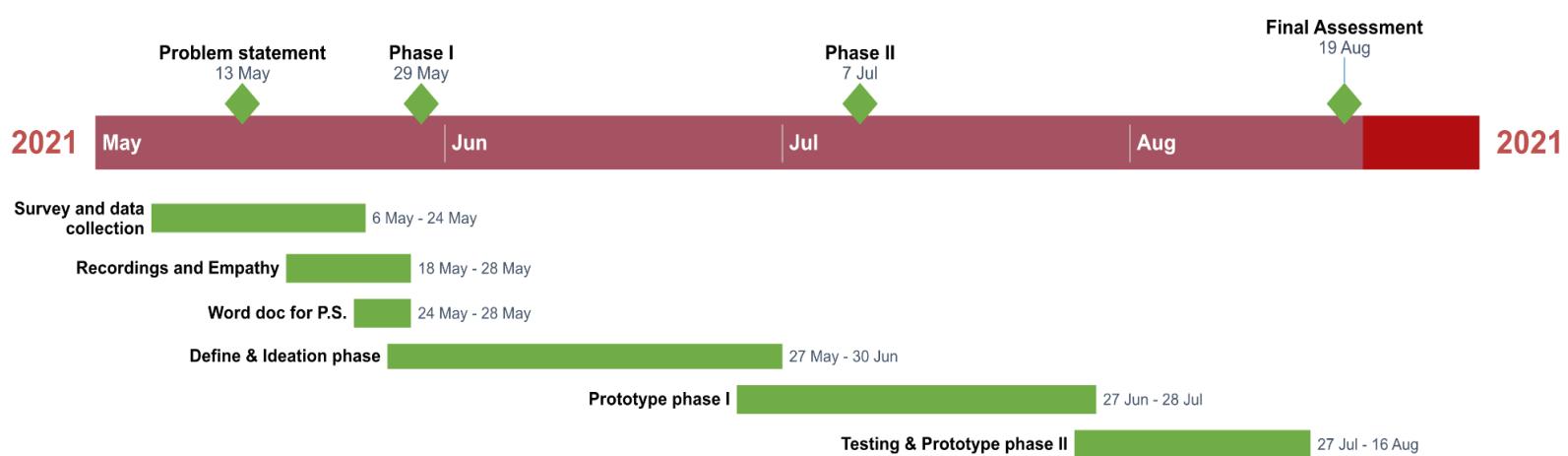
The prediction of fertilizers based on location and proper implementation of algorithms have proved that the higher crop yield can be achieved. From above work we conclude that for soil classification Random Forest is good with accuracy 96.77%. The work can be extended further to add following functionality.

In future,

- Quick links could be provided which would redirect to sites from where farmers could buy the recommended fertilizer.
- We could try to get more data from Agricultural Universities and research centres which would help in validating the recommended fertilizer along with increasing the accuracy of our model and help us in providing the right recommendation to our users.
- Mobile applications can be built to help farmers by uploading images of farms.
- Crop disease detection using image processing in which users get pesticides based on disease images. Implement Smart Irrigation System for farms to get higher yield.
- We could provide a firm comparison between different fertilizers w.r.t. the prices, NPK ratio, chemical composition etc.

Timeline of the project

(Gantt chart)



REFERENCES

- For understanding the current patterns in fertilizer usage by Indian agriculture sector:
<http://www.fao.org/3/a0257e/A0257E05.htm>
- For realising the need and importance of correct usage of fertilizers in farming practices:
<https://link.springer.com/article/10.1007/BF00747584>
- For understanding how to select right fertilizers for the soil:<https://www.berger.ca/en/grower-resources/hints-and-tips/choose-right-fertilizer/>
- Fertilizer Requirements:
<https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/fertilizer-requirements>
- How to choose right NPK ratio:
<https://www.gardenfundamentals.com/fertilizer-selecting-the-right-npk-ratio/>
- Fertilizers::
<https://en.wikipedia.org/wiki/Fertilizer>
- Types of fertilizers:
<https://www.fertilizerseurope.com/fertilizers-in-europe/types-of-fertilizer/>
- More insight on fertilizers:
https://agritech.tnau.ac.in/agriculture/agri_nutrientmgt_fertilizers.html

- Soil testing laboratories:

<https://farmer.gov.in/stl.aspx>

<https://www.napanta.com/fertilizer-dealer>

<https://www.napanta.com/market-price/telangana/warangal/warangal1>

<https://www.ugaoo.com/plant-care/plant-growth/fertilizers.html>

<https://agricoop.gov.in/programmes-schemes-listing>

<https://pib.gov.in/PressReleasePage.aspx?PRID=1725612>