Design and Development of Crop Database Website to help Farmers

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Abstract - *The United Nations report suggests that, by 2050, the World's population will reach around 9.7 billion people. To meet the demands of this growing population, India has to step up its food production by 70%. An efficient way to achieve this is to help the farmers of our nation with proper knowledge on crops and how to grow them by also making certain smart agricultural devices available to them through a website. A database with data of 30 crops is created as an example for analysing crop data. This aims to give information to the farmer as to which crop is suitable for the soil conditions and climatic conditions of his land along with the market value of the crops. Thus, by assisting our farmers with all the information, we can help them get a better yield and to grow the economy of the nation, in turn.*

Key Words: Crop Database, Agriculture, PHP, MySQL, Website Design.

1. INTRODUCTION

India has used many technical advancements to make great walks on the agricultural front. The change of India from a phase of food inadequacy to independent and from a net importer to a net exporter of farming items involves incredible pride. Truth be told, the results have been unlikely, as the nation currently can be proud of delivering around 276 million tons of food products in 2016-17. Close by, the nation is one of the top makers of staple oats (wheat and rice), beats, natural products, vegetables, milk, meat and marine fish. There is an incredible growth in Indian Agriculture due to Indian farmers' courage and determination.

Despite this praiseworthy advancement, monetary pointers don't show any rise to development in pay of the farmers over the states and locale. It is an incongruity that the human factor behind agriculture, i.e., farmers keep on staying in trouble, in spite of persistent productivity and creation. The same farmers are currently trapped in the vortex of progressively genuine difficulties of manageability and reasonability of cultivating. They face the twin vulnerabilities of dangers and vulnerabilities under-way condition and unusualness of market forces. Low and fluctuating livelihoods are a characteristic culmination of a farmer under such weakening conditions.

Agriculture is the main source of food and has a significant role in a nation's economy growth. It also provides many job opportunities to the people. The farmers are as yet utilizing conventional strategies for agriculture, which does not give a better yield. Thus, utilizing smart technologies can help in increasing agricultural productivity.

2. PROBLEM STATEMENT

India is predominantly an agricultural nation where 70% of the revenue comes from agriculture. For the growing population, it is necessary to produce enough food so as to feed them. The climatic changes and extreme weather conditions are posing more problems in farming where our farmers can't gain profit by using conventional agricultural practices.
The farmers play a very important role in increasing the GDP of a nation. But due to their exploitation by middlemen, they face a lot of trouble which will be eliminated by making a user-friendly website available to them to assist them in all aspects

3. OBJECTIVES

The objective of this project is to create a user-friendly website that provides useful information to farmers such as Temperature, Humidity, Soil Moisture, pH, Market Value of the crop and more.

4. RELATED WORKS

A literature survey was done on works on websites created for the sake of agriculture and farming applications. Some of them are listed below.

In [1], Cost management for agriculture using web or app-based system is discussed. This system is useful to farmers as the conventional book keeping is a little harder to maintain records of previous data. This system consists of cloud server, applications and web browsing. It uses Apache, Ruby, and MySQL for the implementation.

In [2], Precision agriculture system based on 5S is discussed. 5s stands for geographic information system, Global positioning system, Remote sensing, spatial decision support system and expert system. Background uses database for the geographic analysis.

In [3], Precision Agriculture for farm-based agriculture for small and marginal farmers is discussed. This paper uses farmer soil-crop database from the field, crop calendars from agricultural experts also uses real-time data of the field through different sensors. An analytical model that simulates crop calendar using dynamic input, semi-static and static inputs to help the farmer through mobile phones and tablets. This software model helps the farmers to increase the profit of their crops.

In [4], Web application that is used to provide fair price to the farmers by devising new techniques and by making use of online market is described. This application helps for movement of agricultural products from the farms direct to the consumers. This application gives privilege for farmers and consumers to buy and sell farm products without the involvement of third person/ middlemen at its right profitable price also the agricultural experts can also analyze this product in this platform and they can provide ratings based on the quality.

The paper [5] describes the main difference between “waterflow model” and “responsive model”. In “waterflow model” analysis for the system requirements, designing for the frontend and backend then evaluation and implementing process. In “responsive design" proper display of web content with same code on different platform like PC, mobile and tablet browsers. Some problems in “responsive model” is loading speed is reduced due to increase in code pages, due to uniform loading of web content on low resolution devices unnecessary flow will be wasted.

The paper [6] differentiates between component-based frameworks and action-based frameworks. The advantage of using component based is modularity. 4 Java component frameworks are explained in this paper they are Java Server Faces, Tapestry, ModelibraWicket and Wicket. Developer of Tapestry can create robust and content rich web applications easily. JSF is configuration framework and not support automatic Ajax generation. Tapestry and JSF uses Inversion of Control mechanism.

In [7], Temperature and Humidity in agriculture field is monitored using CC3200 single chip. A camera is also interfaced with CC3200 which captures images and sends to farmers mobile through MMS when it drops out from ideal range. The drawback of this work is that it uses only Temperature and humidity sensors which is not enough to monitor complete environmental factors. As far as the power supply is concerned, solar power can also be used.

In [8], DHT11 sensor which is used to sense temperature of the air and humidity is implemented by interfacing it with Raspberry Pi. A reading kit is also designed to read the sensed values after which the analysis is performed on web server, Thingspeak that has an API. The analysis indicates that the degree of humidity relies upon the temperature level that they are inversely proportional to each other. This project can also include on controlling the Temperature and humidity of an area.

In [9], A design is proposed to integrate data from different sources by using PostgreSQL. The two data sources include a testing software and a simulation software. These sources contain data which are not structured well. Thus, by using this approach which implements a function to integrate different data, computational costs and data exchange with the client can be reduced because code modularity and the simple system architecture.

In [10], An approach is made to reduce the suicide of farmers across the country. Even though there are many government schemes, farmers are not able to benefit from them because of illiteracy and language barrier. Here a website is developed with many native languages for the farmers’ understanding and easy to use for them. It also provides nearby NGO’s details to seek help when it is most needed to them.

A data mule is created in [11] to help farmers where it can acquire data from many sources such as sensors installed in their fields and various other websites. This may not be official which is why we obtain data from authentic agriculture offices in our approach. The mule designed here also aims to intimate farmers through phones Wi-Fi which is free of cost. This data mule is powered by solar panel and bicycle dynamo which is better step towards balanced ecosystem.

In [12], Sensors for applications like soil preparation, irrigation, crop status, insect and pest detection are listed. Evolving technologies such as Wireless sensors, communication technologies, UAVs, Cloud-Computing are discussed thoroughly. Acoustic sensors, FPGA-based sensors, optical sensors, etc. are explained in detail which helps in selecting what type of sensors can be used to each application. Some of these are too costly which makes automation devices cost ineffective.

5. CROP DATABASE

A database for 30 crops is created to use it for the analysis of which crop suits which soil, what temperature conditions suit the required crop and many more. The data required for the database is collected from various handbooks and agricultural offices.

The database shown in Figure 5.1 gives the value of temperature range in which the corresponding crop will give better yield. Similarly, it gives the value of Humidity range, pH range, rainfall required per annum and the market values of each crop.

	A	B	C	D	E	F
1	Plant name	temperature range	Humidity range	PH range	Rainfall	Market value
2	Arecanut	14-36	70-95%	5 to 7	4500mm(annual)	30k-40k(per tons)
3	coconut	27-32	80-90%	5.20-8	1800-2500	16-40(per piece)
4	Cashew	19-35	40-60%	5.5-7.5	1400-1800	65-70/kg
5	Rubber	21-35	65-90%	5.5-6.5	1250-2000	140/kg
6	Coffee	20-30	80-90%	4.5-7	1000-2000	111/kg
7	Cocoa	15-39	80-90%	6.5-7	1500-2000	180/kg
8	Tea	13-28.9	95-98%	4.5-5.5	2000-4000	180/kg
9	Rice	22-32	60-80%	6-6.7	175-300cm	3000/ton
10	wheat	20-35	50-60%	5.47-5.85	150-300cm	190.50/kg
11	Pineapple	20-30	70-80%	3.5-5.2	600-2500	20-30/kg
12	Mango	27-36	90-95%	5.5-7.5	890-1015	100-200/kg
13	Grapes	25-32	83-86.5%	5.5-6.5	700-800	4160/qntl
14	Watermelon	18-27	60-80%	6.1-7	600-2500	7-15/kg
15	Pepper	14-36	50-70%	6.1-8	100-150	318/kg
16	Carrot	18-23	80-90%	6.5-7.5	1800-2500	30-50/kg
17	Beans	15-29.5	50-70%	6-6.5	1500-2000	40-65/kg
18	Onion	20-25	50-70%	5.5-6.5	750-1000	30-40/kg
19	Tomato	19-30	80-90%	6-6.8	1072-2017	25-40/kg
20	Orange	13-37	85-90%	6-7.5	2000-3000	30-60/kg
21	Sapota	14-25	60-70%	6.1-8	1250-2500	50-70/kg
22	Dates	20-35	60-70%	8-11.1	1200-2000	130-180/kg
23	Collard	4-21.1	60-70%	6-7.5	1000-1250	nil
24	cauliflower	15-21	95-98%	6-6.8	2000-3500	30-45/kg
25	Cabbage	15-20	80-90%	6.1-7	1800-2500	20-40/kg
26	Peas	15-21	50-90%	5.8-7	14-40 inches	15-100/kg
27	Soybean	15-32	50-85%	6.3-6.5	1000-2000	315-320
28	Maize	21-27	70-90%	6-7.2	60-110cm	15-30/kg
29	Barley	13-25	50-70%	5-8.3	390-430	3100/qntl
30	Apple	6-20.2	90-95%	6.1-7	1500-2700	100-200/kg
31	strawberry	15-25	65-75%	6.5-8.5	300-450	100-300/kg

Fig -5.1: Crop Database 1

The database shown in Figure 5.2 lists the soil type for which the corresponding crops are suitable to grow in. It also gives the net yield value in kg per acre or hectare and the amount of time required to harvest these crops.

	A	G	H	I
1	Plant name	soil type	net yield	Duration
2	Arecanut	Moist	20-25qntl/acre	35-47weeks
3	coconut	littoral sands, haviest clays	10000-14000nuts/hectare	12months
4	Cashew	Sandy soils, Sandy loam	40-50kg/acre	3years
5	Rubber	sand or perlite	375kg/hectare	nil
6	Coffee	Sandy loam,fertile volcanic red earth	400-500kg/acre	3-4years
7	Cocoa	clay loam and sandy loam soil	300kg/acre	150-170days
8	Tea	lateritic, alluvial and peaty soils	1,29,145kg/year	6weaks
9	Rice	fertile riverine alluvial soil, clayey loam soil	22-25qntl/acre	120-140days
10	wheat	loam, clay and sandy loam soil	4.49mtric tons/hectare	60-150days
11	Pineapple	sandy and loamy soils	10,000kg/acre	15-18months
12	Mango	lateritic, alluvial and sandy loam	7tons/acre	3-5 years
13	Grapes	sandy loam, red sandy soils	8696kg/acre	15-20days
14	Watermelon	drained sandy, sandy loam and alluvial soil	25-30tons/hectare	80days
15	Pepper	deep loamy and well drained soils	500kg/acre	2-3 months
16	Carrot	Sandy soils, Sandy loam and silted loam	7-8tons/acre	70-80days
17	Beans	Sandy and silty loam soils	23qntl/acre	50-65days
18	Onion	Sandy loam, clay loam, silt loam, and heavy loam	120-140qntl/acre	70-90days
19	Tomato	Well drained , sandy or red loam soil	8-12tons/acre	70-85days
20	Orange	Sandy loa, loamy soils and red to black soil	4.8tons/acre	8-12months
21	Sapota	Alluvial, sandy loam and well drained black soil	4tons/acre	4months
22	Dates	Sand loam or even clay loam	50527kg/acre	60-65days
23	Collard	Moist fertile soil	400-600boxes/acre	60-75days
24	cauliflower	Fertile, well drained, moist soil	20,000kg/acre	90-120days
25	Cabbage	Sandy to heavy soils rich in organic matter	14,000-15000kg/acre	80-180days
26	Peas	Fertile, sandy loam soil	18-20qntl/acre	60-70days
27	Soybean	A loose well drained loam	2.80metric tons/hectare	90-140days
28	Maize	Well drained sandy loam	10-20qntl/acre	100-120days
29	Barley	Heavy clays to light or sandy loam soils	11.84tons/hectare	6-8 weeks
30	Apple	Well drained, laom soils	80-200kg/tree	150-175days
31	strawberry	Well drained sandy loam	25600 pounds/acre	28-30days

Fig -5.2: Crop Database 2

5.1 Applications of the data from crop database

Another aim of the project is to tackle the ups and downs in climate change. A sensor system can be setup and an automatic motor system can be implemented as shown in [1]. For instance, temperature goes too high, a fan should be automatically switched on to cool the air around the plants. Or if the moisture of the soil goes down, then a motor will be switched on automatically to supply water to the plants.

To carry out these automatic tasks, there should be a threshold value for every parameter which when falls out of the range, each task is triggered. In order to set these threshold values, the database is useful.

The graphs given below point the minimum and maximum values of parameters for each crop. These graphs were analysed in the database and plotted, which will serve as intermediate results to set threshold values.

The Graphs 5.3 and 5.4 show the Maximum and minimum values of temperature for each of the 30 crops within which they will give better yield. From the graph we can take an example of Arecanut and see that the maximum temperature is 36 degree Celsius and minimum temperature is 14 degree Celsius. Thus, the threshold value of temperature for Arecanut is 14 to 36 degree Celsius.

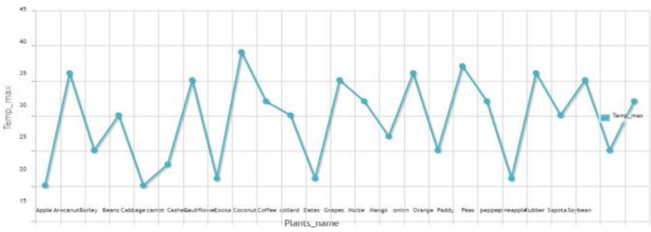


Fig -5.3: Maximum Temperature

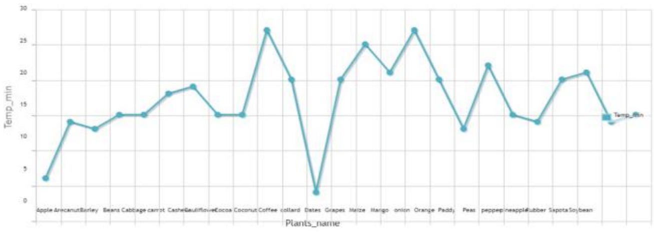


Fig - 5.4: Minimum Temperature

6. DESIGN AND IMPLEMENTATION OF THE WEBSITE

We provide a platform to the farmer by using the database which helps him to decide which crop to plant in what type of soil and in which part of the year. All the weather conditions such as temperature, humidity, rainfall, etc will be given as information to the farmer to make his job easier. To facilitate this setup, there should be a frontend and a backend part.

6.1 Frontend Design

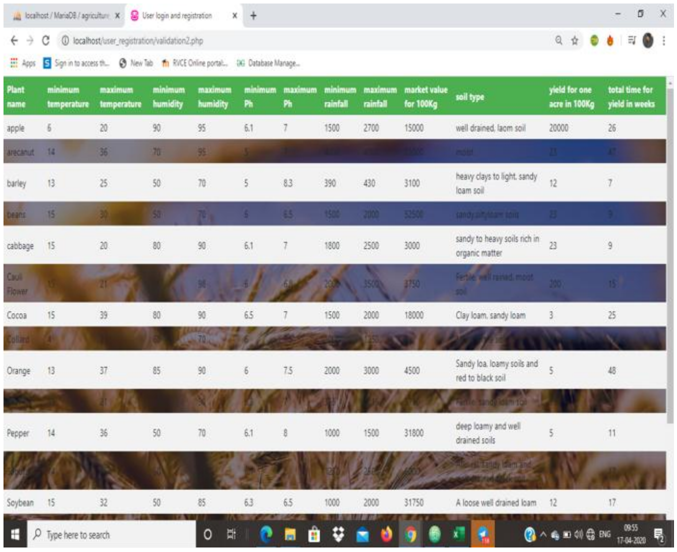
The frontend is designed by using PHP as the scripting language and HTML as mark-up language to design the web page. The Style of the web page and user interface is done by using CSS along with HTML. The interface basically contains User form and Admin form. Here, user can be a farmer or any layman who needs information about crops. Admin will be the one who has access to alter the crop database and to add new crops and their corresponding parameter values. Since Admin has full access to the database, he will have to enter login credentials such as admin id and password. But user part does not have any such credentials to enter.

In the admin form, once login credentials are entered, there will be a page in which he can enter a new crop and its parameter values or edit an already entered crop in the database. This data from the webpage is to be stored in the database. So, this will be processed through PHP and JavaScript.

In the user form, there will be textboxes for crop name, parameters like temperature, soil type, market value, rainfall, etc. The system is designed such that, when user enters values into any one or more of these textboxes, data will be retrieved from the backend database such that it satisfies all the required queries from the user. For example, if the user enters a crop name, then all the parameter values of the crop will be displayed. If he enters only soil type, then all the crops that can be grown in that soil type along with other parameters will be displayed. The user can also enter more than one value, like soil type and temperature, while now the page displays all the crops that satisfy these soil type and temperature conditions. The retrieving of information from database again requires PHP.

6.2 Backend Design

The backend uses MYSQLi to create and edit crop database. MySQLi is the OOP version of MySQL extension. To host the connection of frontend and backend, WampServer is used which is a localhost. Any storing and retrieving functions that happens, takes place in this localhost. The database that is created is shown in Figure 6.1



Plant name	minimum temperature	maximum temperature	minimum humidity	maximum humidity	minimum Ph	maximum Ph	minimum rainfall	maximum rainfall	market value for 100Kg	soil type	yield for one acre in 100Kg	total time for yield in weeks
apple	6	20	90	95	6.1	7	1500	2700	15000	well drained, laom soil	20000	26
arecanut	14	36	70	95	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	moist	[illegible]	[illegible]
barley	13	25	50	70	5	8.3	390	430	3100	heavy clays to light, sandy loam soil	12	7
beans	15	30	50	70	6	6.5	1500	2000	52500	[illegible]	[illegible]	[illegible]
cabbage	15	20	80	90	6.1	7	1800	2500	3000	sandy to heavy soils rich in organic matter	23	9
Cauli Flower	[illegible]	21	[illegible]	98	6	[illegible]	[illegible]	3500	3750	[illegible]	[illegible]	15
Cocoa	15	39	80	90	6.5	7	1500	2000	18000	Clay loam, sandy loam	3	25
Collard	[illegible]	[illegible]	[illegible]	70	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Orange	13	37	85	90	6	7.5	2000	3000	4500	Sandy loa, loamy soils and red to black soil	5	48
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Pepper	14	36	50	70	6.1	8	1000	1500	31800	deep loamy and well drained soils	5	11
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Soybean	15	32	50	85	6.3	6.5	1000	2000	31750	A loose well drained loam	12	17

Fig -6.1: Crop Database created in MySQLi

7. RESULTS AND DISCUSSION

The figure 7.1 shows the Home page having options for a farmer or admin to login. The farmer will have to enter the name to access crop info, thus anybody who has an access to

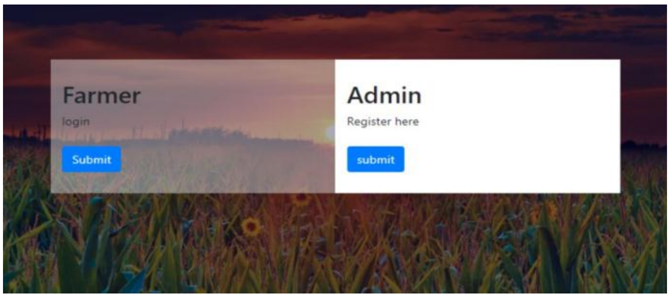


Fig -7.1: Home Page

The website can obtain the information of crops they are looking for. The Admin will have to enter login credentials, name and password, because he will be having access to the main database to which he can add a new crop or update an existing one. Thus, security is provided to the database as well as made user-friendly to the farmer.

The Figure 7.2 shows the Farmer Name Entry after which he will be directed to crop information page as shown in figure 7.3. Farmer can enter one or more values and retrieve data from database. Here, if the temperature value, 15 in degree Celsius is entered and submitted, a page showing all the crops that satisfy the required temperature would be displayed.

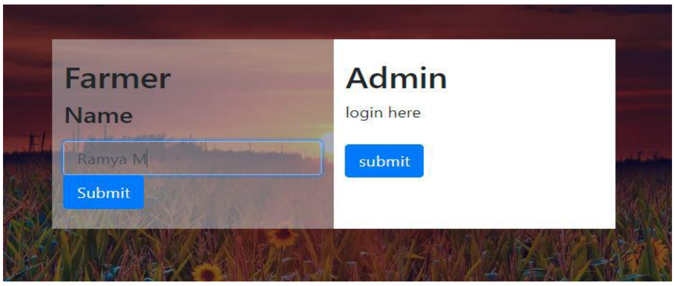


Fig -7.2: Farmer Login

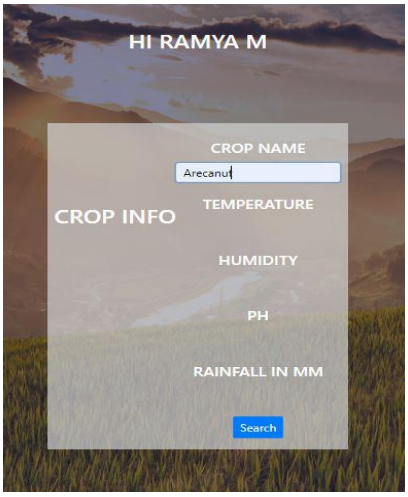


Fig -7.3: Entering crop name

Here, Crop name is entered as Arecanut in figure 7.3 which will fetch all the parameters required to grow Arecanut to the farmer. The page will appear as shown in figure 7.4 To enter other parameters such as temperature, humidity, etc., sensor devices such as DHT11 as shown in [8] will help the farmers. When two or more such values are entered, all the crops that satisfy that particular condition will be displayed.

Fig -7.4: Crop info output

For the admin to login, username and password has to be entered for security purposes. In figure 7.5, this step is demonstrated.

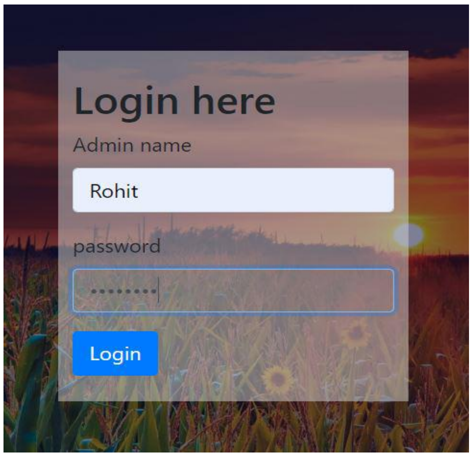


Fig -7.5: Admin Login

Once the admin is given access after entering correct login credentials, he will have two options; To register a new crop and to update an existing crop as given in 7.6.

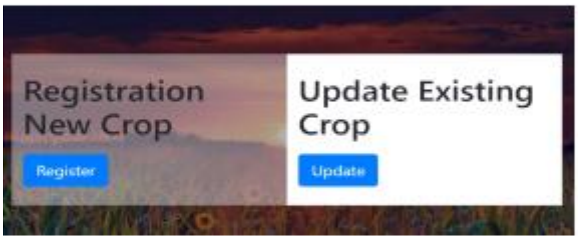


Fig -7.6: Admin options

If the first option is selected, a page asking to enter parameters for a new crop will appear. Any crop with authenticated parameters can be entered as shown in figure 7.7. These values are obtained from genuine sources such as agriculture offices and handbooks.

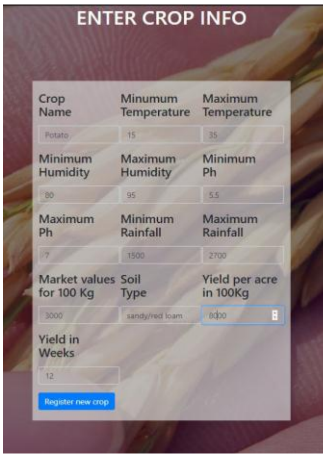


Fig -7.7: Adding a new crop

Fig -7.8: Acknowledgement Message

Once the values are entered, an acknowledgement message will be shown to ensure that crops are entered into the database. This is shown in figure 7.8. If the second option is selected, a page asking for parameters that need to be updated for an already registered crop will appear.

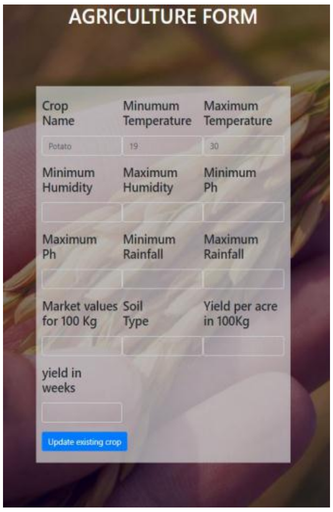


Fig -7.9: Updating an existing crop

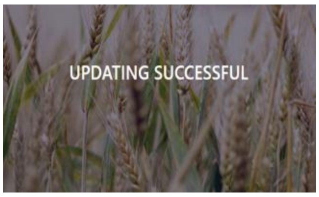


Fig -7.10: Acknowledgement Message 2

Any one or more than one parameter can be entered and the others can be left blank as shown in 7.9. In the database, only the specified parameter will be updated leaving the old ones intact. This updating is acknowledged as shown in 7.10.

8. CONCLUSION

Given the current scenario of growing population, reduced labourers, and adverse climatic conditions, it is evident that the conventional agricultural practices have to be improved. This project proposes the design of a website which helps farmers to make decisions on which crop to grow in what type of soil. It will provide crop information to farmer selective to his soil conditions. This website is hosted globally which can be accessed by anybody so that it can be of more help to the nation.

By applying these database information and analysing data obtained from sensor system, certain actions can be taken to tackle the challenges faced by a farmer in extreme climatic conditions. By automating the triggering actions, the challenge of reduced labour is overcome. As far as the website is concerned, as the number of users increase and as the server-side load increases, the code complexity also increases.

If the hardware part is deployed and made use by a farmer, the yield is expected to increase by 18% than when farming is done without implementing any technology.

As an extension to this work, more crops can be added to the database which will give space for precise analysis. In this read, extra parameters such as pesticides, fertilizers that are used for each crop can be added. The website can be made more robust in order to reduce the server-side load.

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