Project Report on Data analysis and prediction for agricultural production

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Project Report on Data analysis and prediction for agricultural production

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Contents

List of figures

List of tables

Abstract

Agriculture is the backbone of Indian economy. Due to global warming and climate change traditional farming in the regular months have been distorted and crops have been ruined is the most common phrase seen today. This not only gives economic losses but also the main reason for farmer sucide. Now agriculture needs support, time has come for technology to take over change. For a crop to grow ,favourable soil conditions, ambient rainfall and temperature is necessary. So as now due to climate change temperature and rainfall cannot be well defined , example rains in December and January or irregular temperatures have made it difficult for farmers and common man to predict months of plantation and yield of the crop due to irregularities. So we have formulated an analysis by prediction of a favourable crop based on temperature and current rainfall with soil conditions.

Data science have proved that data which we have plays a vital role in predictions and iot based applications. Data science in agriculture is a growing field and has a wide scope in future.

Following are various applications of Data Science in agricultural sector:

1. Soil and Crop analysis

2. Weather Prediction

3. Fertilizer Recommendation

4. Disease Detection and Pest Management

5. Adaptation to climate change

6. Automated Irrigation System

In this Project, we are analyzing data of Soil and Crop and weather for crop prediction.

1:Introduction

1.1 Introduction

Weather plays an important role in agriculture production. Thus there is no aspect of crop culture that is immune to impact of weather. Weather factor contribute to optimal crop growth, development and yield. For rainfall variability needs to be expressed in terms of percentage so that minimum assured rainfall amounts at a certain level of probability. For optimal productivity at a given location crops must be such that their weather requirements match the temporal match of relevant weather elements. A detailed knowledge of rainfall regime at a place is an important prerequisite for agriculture planning and management. Soil fertility refers to the inherent capacity of soil to supply nutrients in adequate amount and in suitable proportion for crop growth and crop yield.

1.2 Objectives

1. Preparation of fields for sowing of a crop with adequate availability of seed zone
2. Contributing to optimal crop growth, development and yield.
3. Predict appropriate crop from given temperature and rainfall and soil.

1.3 Organization of Report

The following chapter describes literature survey. Chapter 3 gives a system overview. Chapter 4 provides technical details about microcontroller programming. Chapter 5 and 6 describes experiments and results obtained. Chapter 7 gives ideas about further addition that can be done to the project. Chapter 8 concludes the report

2.Literature survey

Significance of analysing Temperature, Rainfall and Soil:

1. It has a profound influence on crop growth, development and yields. Weather aberrations can cause physical damage to crops.
2. Well distributed rainfall is an important factor determining yield.
3. A defined range of maximum and minimum temperatures from the boundaries of observable growth.
4. The impact of climate change are most evident in crop productivity because this parameter represents the component of greatest concern to producers, as well as consumers.
5. Warming temperatures associated with climate change will affect plant growth and development along with crop yield. Increase of temperature may cause yield declines between 2.5% and 10% throughout 21^{st}century.
6. Global warming affects agriculture in a number of ways, including through changes in average temperature, rainfall.

Advantages of using Matlab in analysing data:

1. Datatypes and preprocessing capabilities designed for engineering and scientific data.
2. Thousand of prebuilt functions for statistical analysis, machine learning and signal processing.
3. Accelerated performance with simple code changes and additional hardware.

3. System overview

3.1 System overview

Numeric data is easier to handle hence soil is converted in numeric value. According to water retainity soil is divided into 10 parts with 10 as max retainity soil and 1 the lowest water retainity.

Water retainity index	1	2	3	4	5	6	7	8	9	10
Example soils	Sandy soil		Sandy loams	Black soil(basalt)		Red soil		Loam soil		Clay soil

Table 3.1. Water retainity

Accordingly we have developed a prediction where current temp, soil condition and rainfall when entered we tell the crop which will give the highest yield. India is a land of diversity and varied soil conditions are found here.Each crop needs varied soil conditions and hence india is a homeland for production of various crops. According to water retainity these soils when divided are good for a particular crop. The following graph shows crops and corresponding water retainity .

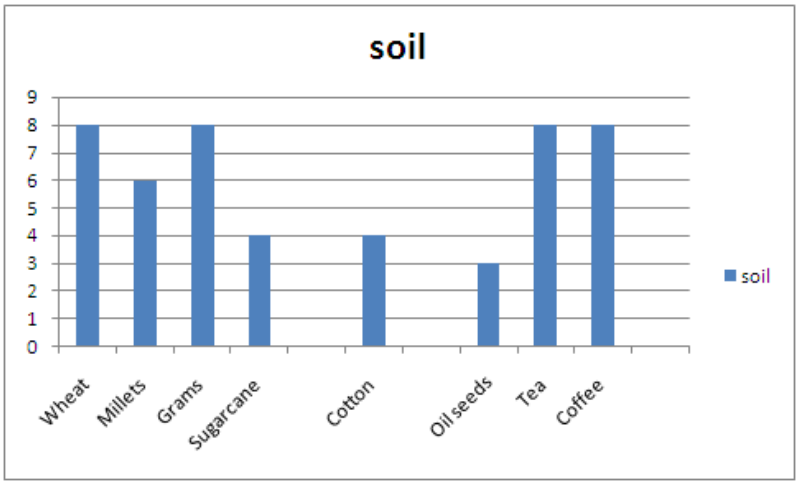

Fig 3.1. Crops with favourable soil

Other than soil, rainfall and temperature plays an important role in yield of crop; some crops like rice need ambient rainfall whereas wheat and oilseeds need nearly very less rainfall. Similarly

temperature also plays a vital role in crop quality.Hence a fixed range of rainfall and temperature is given by the authority of agriculture and best yield of crop is determined.

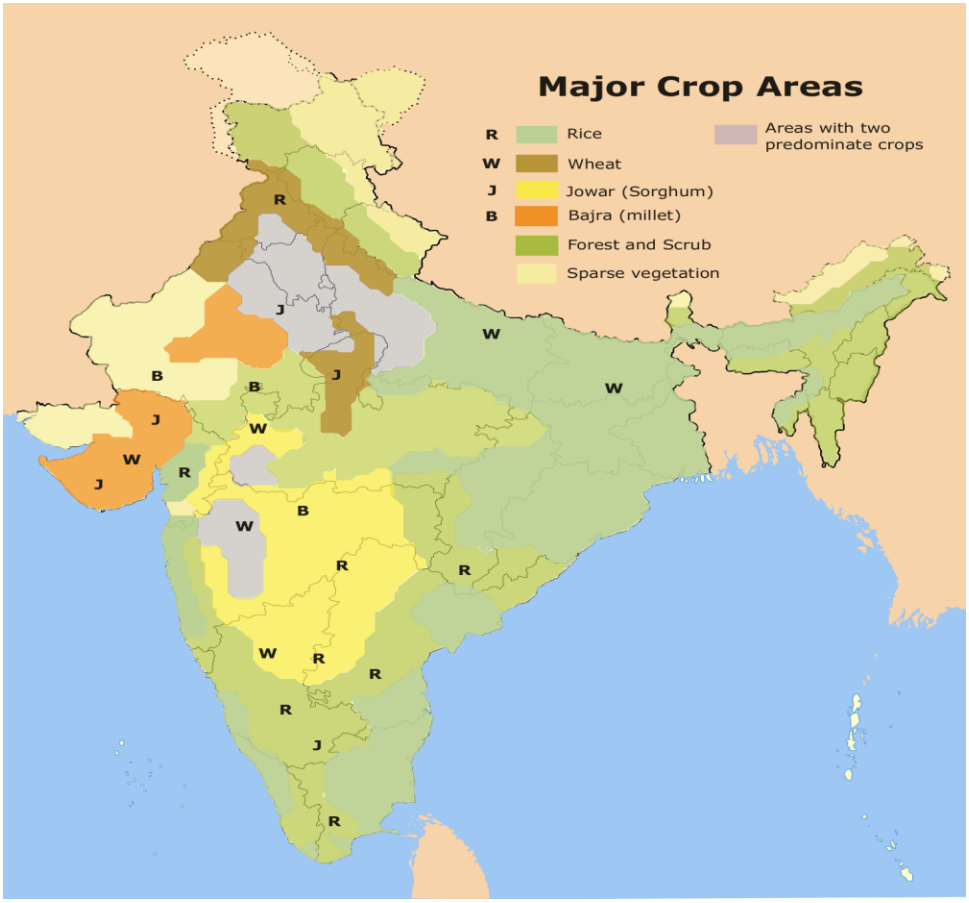

Figure 3.2 Crops in india

According to rainfall and temperature conditions found in india traditionally a crop place was taken into consideration for its vegetation.But now due to weather conditions and irregularities in rainfall one cannot cultivate without taking into consideration temperature parameters.
Favorable rainfall and temperature range is given for a crop and soil conditions are given for a crop. Accordingly the table shows main crops grown in india and having favourable range of temperature and rainfall with soil conditions.

Sr no	crop	Temp range	Rainfall range	soil
1	Rice	22-32 degree celsius	150-300 cm	Clay soil
2	Wheat	10-15 degree celsius	75-100 cm	Loamy soil
3	Millets	27-32 degree celsius	50-100 cm	Red soil
4	Grams	20-25 degree celsius	40-45 cm	Loamy soil
5	Sugarcane	20-27 degree celsius	75-100 cm	Blacksoil (basalt)
6	Cotton	21-30 degree celsius	50-100 cm	Blacksoil (basalt)
7	Oil seeds	20-30 degree celsius	50-75 cm	Sandy loams
8	Tea	20-30 degree celsius	150-300 cm	loamy
9	Coffee	15-28 degree celsius	150-250 cm	Loamy

Table 3.2. Crops with favourable soil,rainfall and temp range

Accordingly we have developed a prediction where current temp, soil condition and rainfall when entered we tell the crop which will give the highest yield. This data will maximize the production yield and no farmer has to depend on their luck for the plantation.

3.2 System details

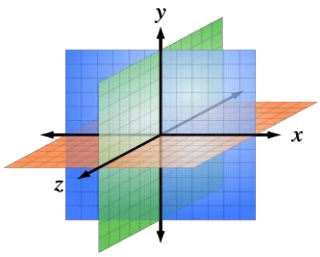

Fig 3.3 3d axis

Now 3 parameters are varying hence we should consider a 3d geometry where each axis represents a parameter.
X represents- temperature
Y represents- rainfall
Z represents- soil
Each crop has an area in which the conditions are favourable.
Considering for sugarcane temp:20-27 rainfall:50 to 100 and soil (4)
Hence the rectangle in 3rd geometry is formed.
For convenience if we divide this 3d graph into 3;2d graphs.

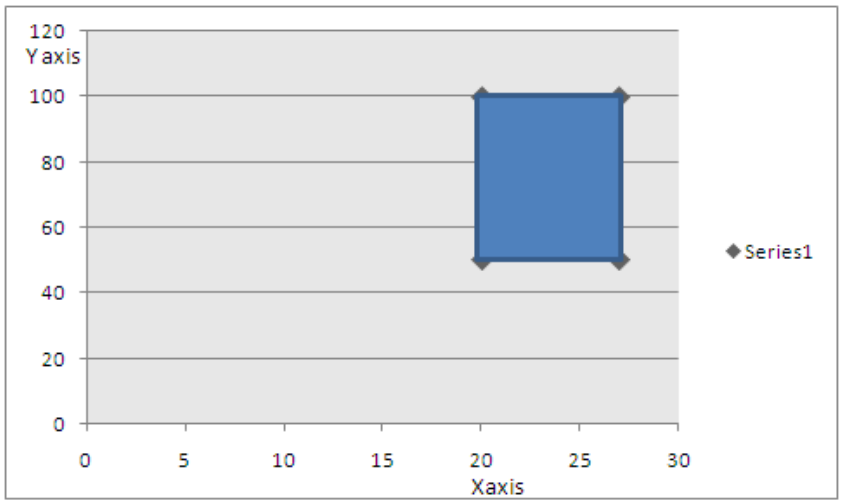

Fig 3.4

This graph shows:(y vs x)
X axis:temperature(celcius)

Y axis:rainfall (cm)
This shaded rectangle shows a favourable region for sugarcane.

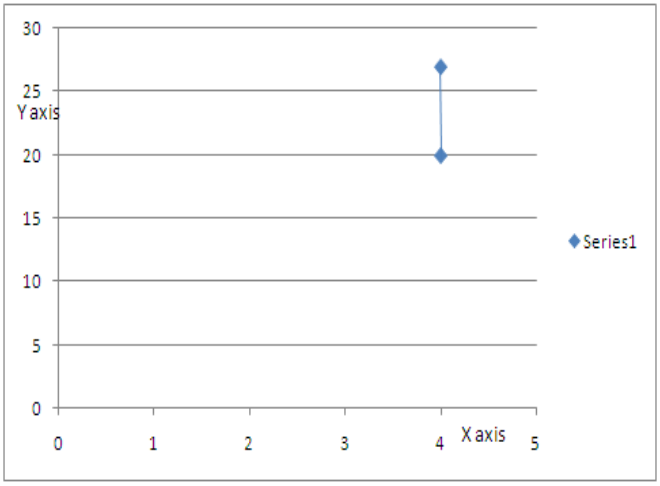

fig 3.5

This graph shows:(z vs y)
X axis:soil (numeric)
Y axis: temperature (celcius)
This shaded line shows a favourable region for sugarcane.

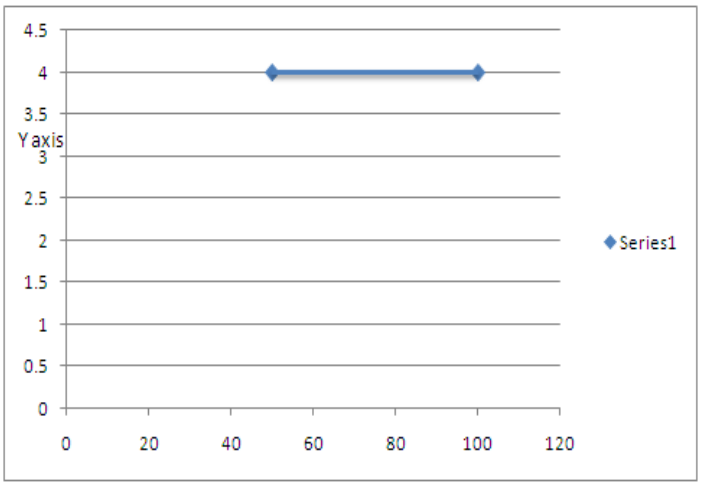

Fig 3.6

This graph shows:(x vs z)
X axis:rainfall(cm)
Y axis: soil (numeric)
This shaded line shows a favourable region for sugarcane.

If all 3 parameters defined from the user of temp, rainfall and soil match then print following favourable crop.

If the parameters don't match then find the least error corresponding to all three parameter.

Example if we consider current

1. temp:21 degree cel
2.rainfall: 120 cm
3.soil (5)

step1.

So error= (temp)

If ; lowerlim<Current temp<higherlim

Then error is 0

Else error=

If

|lowelim-current value| > |higherlim-current value|

Use higherlim=a

Else

Use lowerlim=a

Error ={ (current value - a) / current value}*100

Let this error be P.

So error= (rain)

If ; lowerlim<Current rain<higherlim

Then error is 0

Else error=

If

|lowelim-current value| > |higherlim-current value|

Use higherlim=b

Else

Use lowerlim=b

Error = {(current value-b) / (current value) *100}

Let this error be Q

error(soil)

If

data soil(num)= current soil(num)

error=0

else

error= datasoil/currentsoil *100

Let this be R

Total error= P+Q+R

Step2.

Find error for each crop

Step 3.The crop with minimum error is given as output

3.3 Experiment

Traditional way of crop production

% error=Actual temperature in each month in Pune-Expected temperature for crop*100/Expected temperature for crop

% Crop Production =100-%error

Output :

Rice

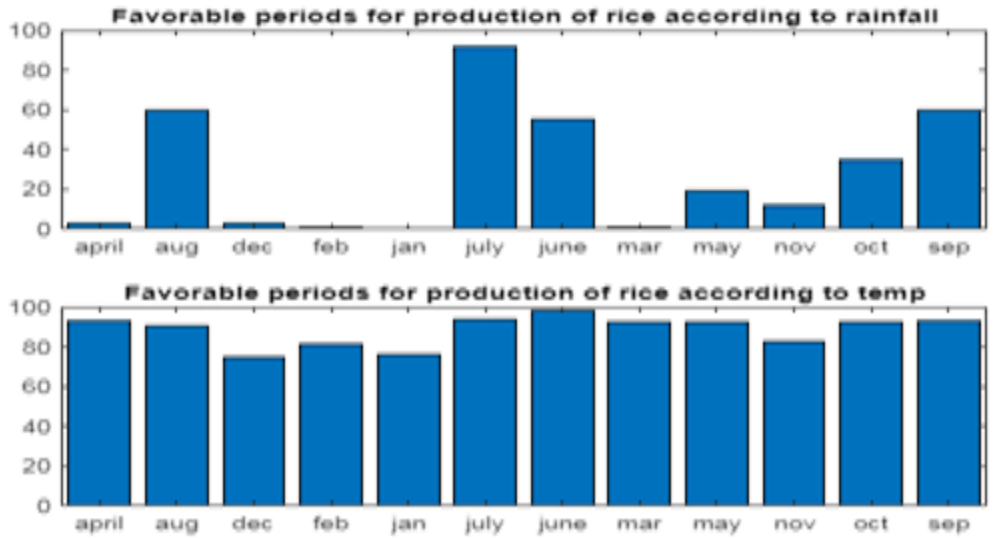

Fig 3.7 Favorable periods for production of Rice

Sowing time for rice is Jan-March as temp required is suitable and harvesting time is april-july.

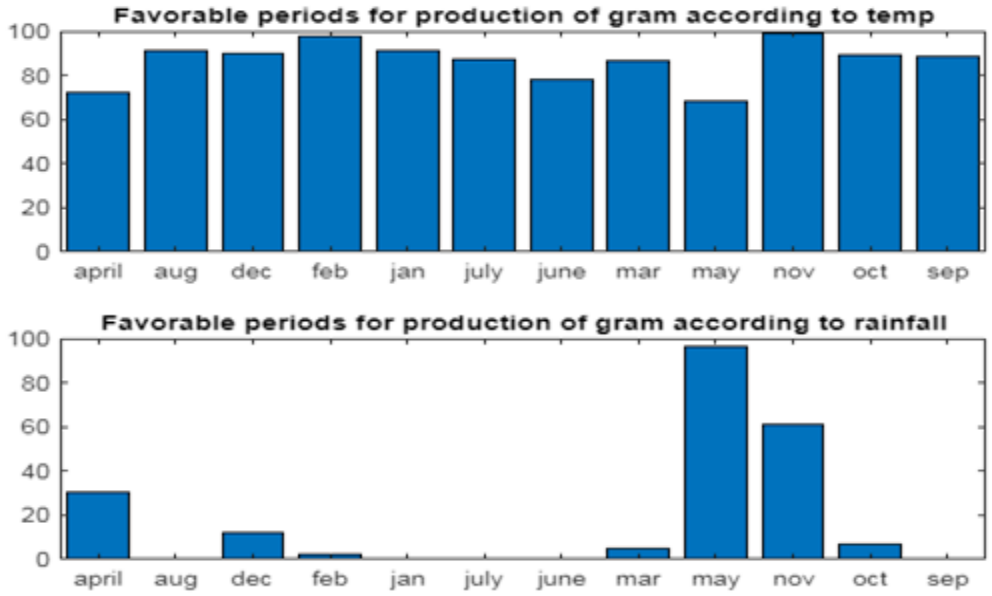

Fig 3.8 Favorable periods for production of gram

Sowing time for gram is oct-dec and harvesting time is Jan-Mar.

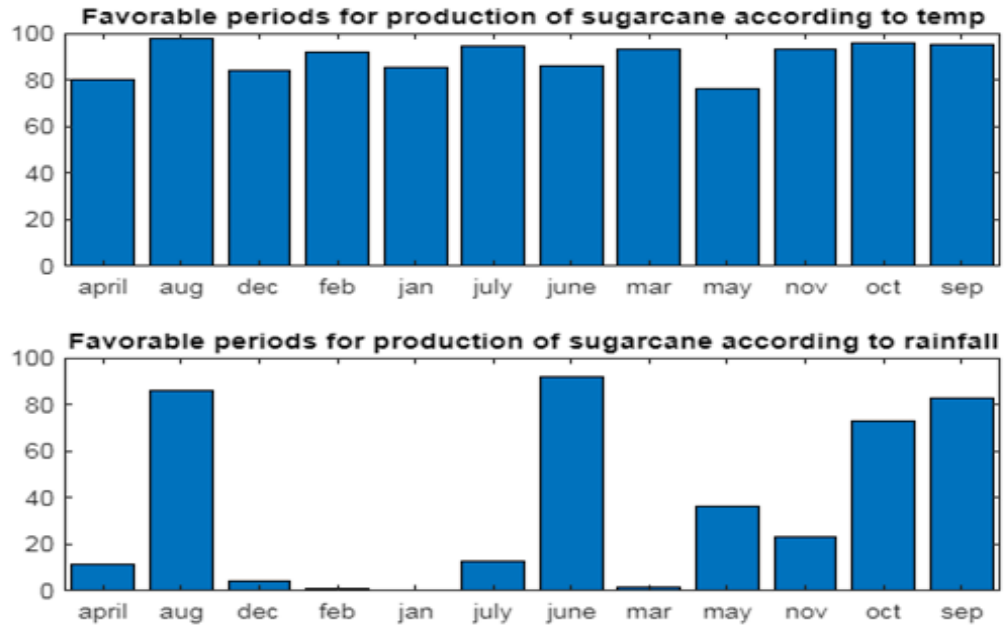

Fig 3.9 Favorable periods for production of Sugarcane

Sowing time for sugarcane Jan-Mar period for planting and Dec-Mar is period for harvesting.

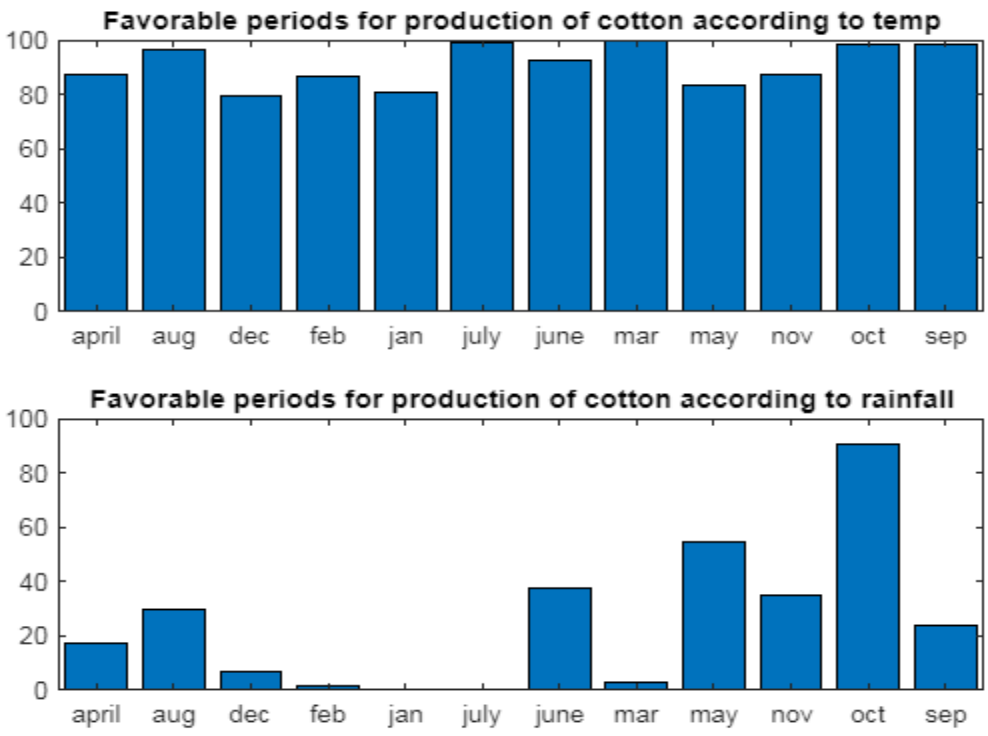

Fig 3.10 Favorable periods for production of Cotton

Sowing period for cotton is aug-sep and harvesting period is feb-apr

Due to global warming and climate change traditional farming in the regular months have been distorted and crops have been ruined is the most common phrase seen today. This not only gives economic losses but also the main reason for farmer suicide. So as now due to climate change temperature and rainfall cannot be well defined , example rains in December and January or irregular temperatures have made it difficult for farmers and common man to predict months of plantation and yield of the crop due to irregularities. So we have formulated an analysis by prediction of a favourable crop based on temperature and current rainfall with soil conditions.

To overcome this climate changes and avoid losses**,** we have implemented following:

Step 1: If all three parameters (Soil, Rainfall, Temp) match in the given range then print crop.

Step 2: If parameters don't match in given range then find error with respect to given data in terms of actual temperature, rainfall and soil conditions.

4. Conclusions

4.1 Merits and Demerits

Merits

1. 1. Weather aberrations can cause physical damage to crops.
2. 2. Help in cut costs.
3. 3. Product higher crop yield.
4. 4. Prevent over or under watering.

Demerits

1. 1. Sudden change in weather cause crop damage

4.2 Conclusion

Weather aberrations can cause physical damage to crops.With help of this project we can predict in certain environmental conduction which crop should be taken.From the graph of % of production we can determine sowing and harvesting period of particular crop in given temperature and rainfall.This data will continue to enhance farmer efficiency by further enabling them to monitor each plot of land and determine the precise input needed for their crops.

4.3 Future scope

1. Predict appropriate crop and maximum yield in the climate change.
2. Create an android app.
3. Collection of data, Analysis of it and modification of the algorithm.
4. IOT application in agriculture, automation in production line and man free agriculture which is the future of the world ,this is the first step of it.
5. Find the percentage yield to happen from the match given percentage in terms of % error.

References

https://www.noble.org/news/publications/ag-news-and-views/2001/september/soil-and-water-relationships/
https://www.jagranjosh.com/general-knowledge/list-of-major-crops-of-india-temperature-rainfall-soil-1473918924-1
https://mail.google.com/mail/u/0/?tab=rm&ogbl#inbox/KtbxLthVdScFrqFwSlJwmjlwtMJQTcWmgq?projector=1&messagePartId=0.1
https://mail.google.com/mail/u/0/?tab=rm&ogbl#inbox/QgrcJHsbjCZLbpXskSwGkvRhRHVGTsGPvPL
https://mail.google.com/mail/u/0/?tab=rm&ogbl#inbox/KtbxLwgswrWrQzWGcQHRxtBcTlFjscDQkL
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