DATA VISUALIZATION FOR AGRICULTURE

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Data Visualization For Agriculture

Minor Project Report

Submitted in partial fulfilment of the requirements

For the degree of

Bachelor of Technology in Computer Science & Engineering

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CERTIFICATE

This is to certify that the minor project entitled "**Data Visualisation for Agriculture**" submitted by **Shaili Patel(18bce168)** & **Manaswi Pipaliya(18bce177**), towards the partial fulfilment of the requirements for the degree of Bachelor of Technology in Computer Science and Engineering of Nirma University is the record of work carried out by him/her under my supervision and guidance. In my opinion, the submitted work has reached the level required for being accepted for examination.

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ACKNOWLEDGEMENT

I am sincerely grateful to Nirma University, Ahmedabad to provide me with this opportunity to work on this project. Under the guidance of Dr Purnima Gandhi, we were able to tackle all the challenges we faced while working on this minor project. Without her supervision, we would not have completed this project. I also extend my appreciation to my teammate who has always been actively brainstorming ideas for this project. From this project, I have learnt a lot about how data can impact farming. Prescriptive crop planning can bring huge profits to the farmers using data. I feel immensely grateful to my parents for their support and guidance.

Last but not least, I would like to thank all of you who are not mentioned in this project, but have helped me throughout this project. They have inspired me all the way.

CONTENTS

ABSTRACT

Farming is always seen as an innate domain, having knowledge transferred from father to son or from one generation. However, these days the climate is changing. We often find irregularities in rainfall patterns. Deforestation combined with rising population has influenced the farmers to produce more consumable products which soak all the fertility of the soil. Farming and agriculture require a lot of information. As the population increases, farmers also need to increase their production and yield. In order to achieve this, they need to plan the crops based on historical data which can be collected from several sources like smart gadgets, bills etc. So there when data visualization for agriculture comes into the picture. When we represent data that is raw and collected from different sources and different formats into a visualization format, it's possible to gain insights. In this project, we took a step forward to collect data from primary sources and clean it. Cleaning data is extremely important as it may interfere while gaining knowledge. Then we have used python programming language to build a dashboard using which we can integrate all the data and find patterns. We have considered a few parameters like crop production, area harvested, climate and gave an overview of the most produced commodities in India, Morocco & Russia.

Chapter 1: INTRODUCTION

The significance of conducting sustainable and successful agriculture is becoming increasingly clear. Advanced computers and the internet have made it very easy to create visuals from summary statistics and to also add dynamism and interaction to these visualizations through data visualisation tools. This project is to investigate the effect of climate change on the fertility of the soil and compare the overall statistics of agricultural reproduction for the countries like India, Morocco & Russia. The reason we choose Morocco in our study is that it's one of the few Arab countries that have the potential for food production. Russia was chosen as India and Russia have similar currency values. In order to compare agricultural production and yield, we have built a dashboard.

Problem Statement

In this project, we want to convert information from data sources which when used raw, cannot give proper insights to a tool using which we can deliver insights to farmers, researchers or any stakeholders involved in agriculture. Thus to overcome the problem of planning without using insights and experience can be solved using the dashboard system to plot all agricultural data or information. We have done a comparative analysis between India, Morocco & Russia to show that dashboards and data visualization tools can also be helpful to farmers to compare their production with other cities, states or countries.

Process

- Literature survey and understanding the problem definition
- We then collected required data from primary and secondary sources
- Then we move on data cleaning step where we handled missing and NULL data values
- After that, we also checked out for duplicate records
- The next step was to organise the data and then plot bar graphs
- We then brainstormed about what additional features and data we can add
- Iterate all the steps again and again as per requirement

Tools

Chapter 2: LITERATURE REVIEW

After reviewing the two studies [1] and [2], we got to know a lot of background information about data visualization, big data and more importantly the need for data visualization in agriculture. This paper presents the design and implementation of data visualization for agriculture. However, they were focused more on prescriptive crop planning. According to Wikipedia, Prescriptive crop planning is the process of planting crops based on previous observations and measurements. These papers summarise that by combining programming languages and critical thinking skills, we can develop more efficient data visualisation tools for agriculture. Machine learning, IoT & smart sensors collect numerous amounts of data. But they are useless if not used wisely. That's when Data mining techniques come into play. Using data mining techniques, one can find and unravel patterns from data using which we can make our businesses more profitable. By using Big Data, we can produce much more useful insights into the agriculture industry. One can get valuable information from dashboards using different analyses like predictive, prescriptive, diagnosis & descriptive analysis. There are many firms like my smart farm, ATP labs & FieldIn who use big data tools to revolutionize the agriculture industry. Data visualization for agriculture not only limits agriculture but also aquaculture as well. Many companies like KCT waterbase invest a lot into research to produce better quality shrimps. In this manner smart farming using IOT can lead to humongous profits but the data aggregated from these devices should be utilised efficiently. Smart farming is crucial as there are many issues in the agriculture industry[3] like soil monitoring, climate change monitoring, production quantities. Also supply chain management is one of the challenges faced by the agriculture industry[3]. By creating dashboards tools and using big data, we can lessen the burden on farmers in many ways. Farmers will be able to improve crop production, quality and also waste less resources like fertilizers , water and electricity. The users of the dashboard will be able to analyse rainfall patterns, climate change, soil fertility, water cycle and many more.

Chapter 3: METHODOLOGY

The code for this project is available on our GitHub account. Once you git clone this project, navigate to the project directory and run these commands to deploy your dashboard:

```
minorP\Scripts\activate.bat
streamlit run dashboard.py
```

This will activate the virtual environment where you have installed streamlit and other required libraries for building a dashboard.

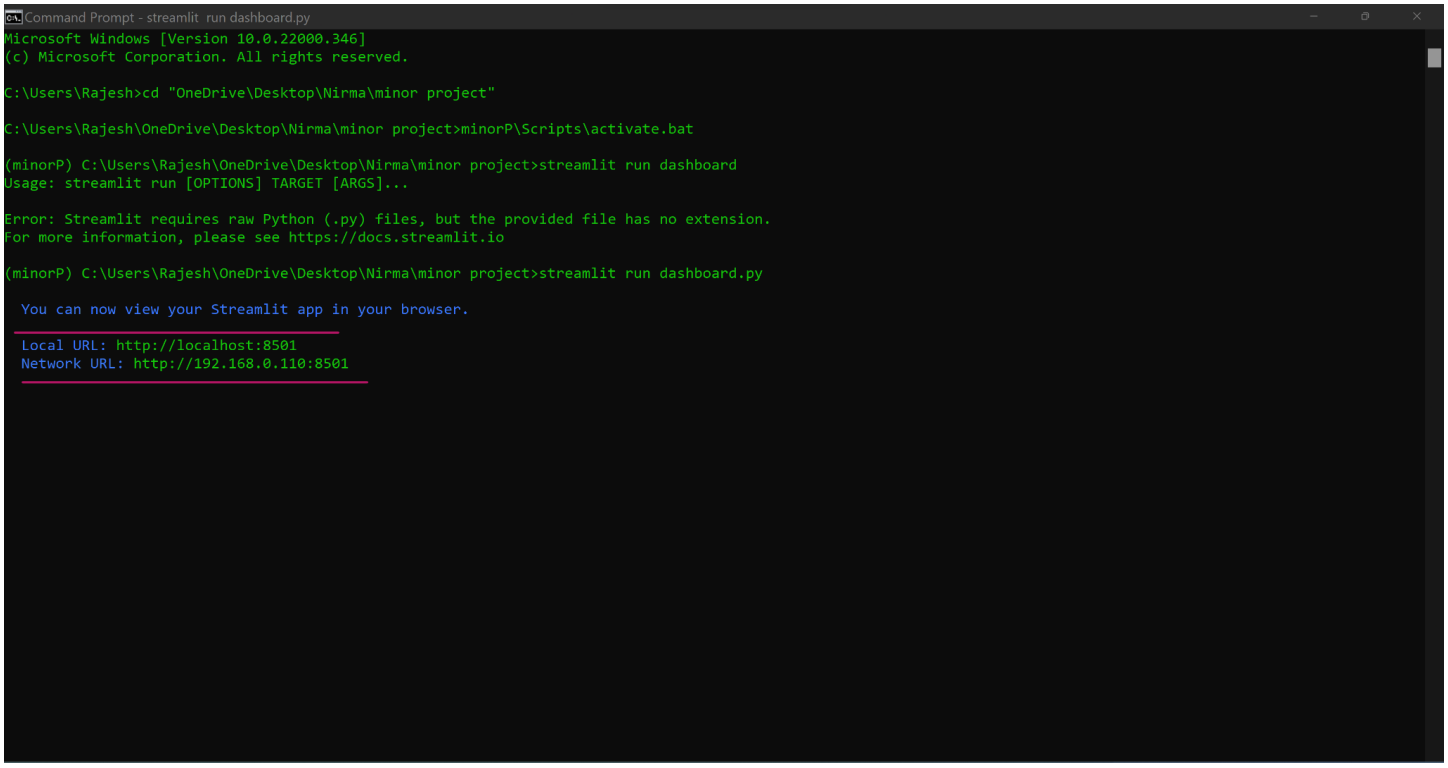

Fig-1 Screenshot of command prompt showing implementation of dashboard

At this address, you can find your dashboard. The below image is how our dashboard looks like. We have worked on three different parameters: one is crop production, the second is production value and the third is mean temperature change.

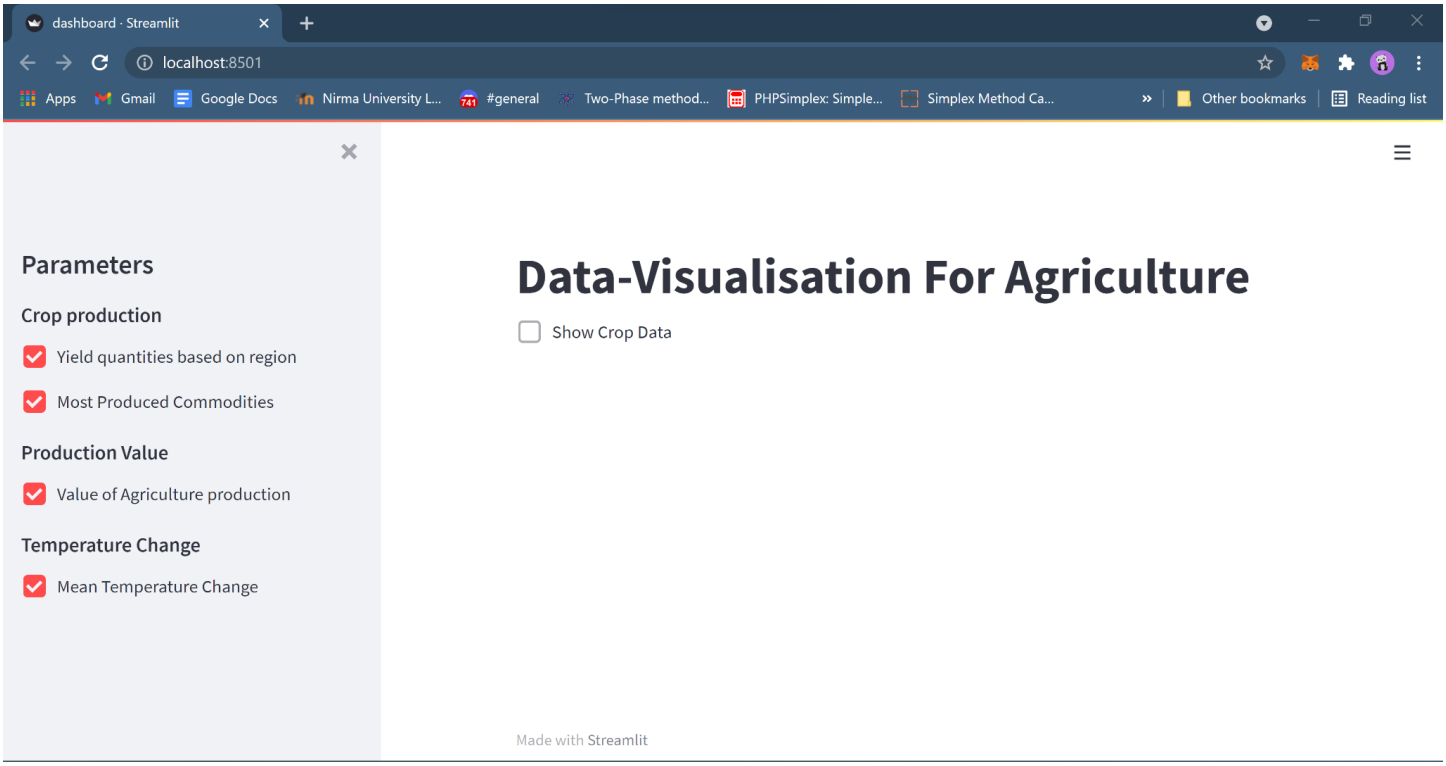

Fig-2 Screenshot of our dashboard

The checkboxes on the sidebar mean that the charts are hidden. Upon clicking them, one can see the visualization on the main screen. Once we click on the first parameter that is yield quantities based on the region, more parameters would then be visible. The first is a region and the second is items. Upon clicking on a region, we have a dropdown list that allows us to choose the country of our interest. One can choose anything from India, Morocco & Russia. The item parameter is used to see the visualization of specific products like sugarcane, apples, wheat, barley and the list goes on.

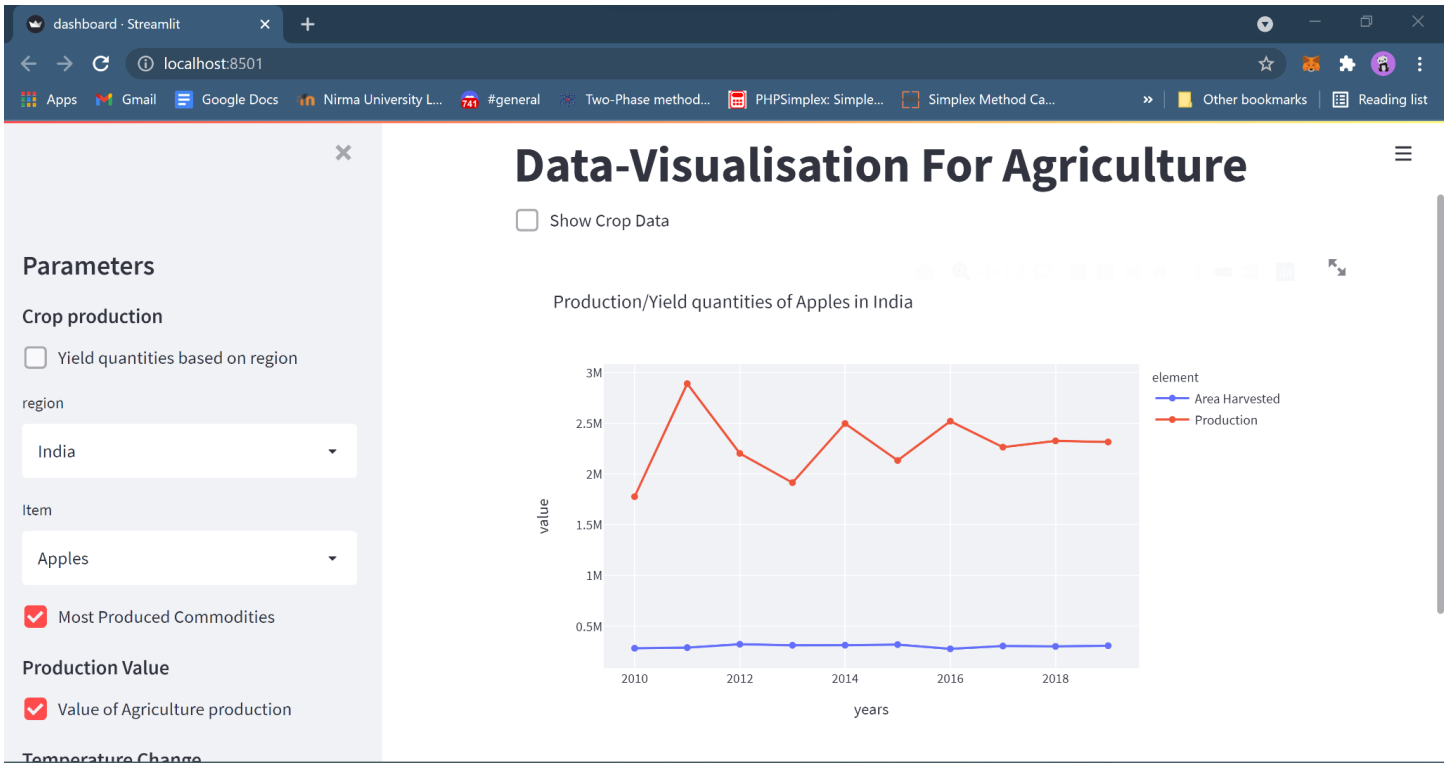

Fig-3 Screenshot of our dashboard showing implementation of first parameter

Upon clicking the second parameter i.e crop production, we now can see the information of most produced commodities for India, Morocco & Russia. In this, we have an option to choose which chart we want to look at. For example, if someone is not familiar with line plots then they can go for the pie chart. This way anyone can use this dashboard and get insights without having much knowledge of graphs. There is a show data check box on the main screen which allows us to get a preview of the data. For simplicity, we have added 1-20 rows for the show data check-box.

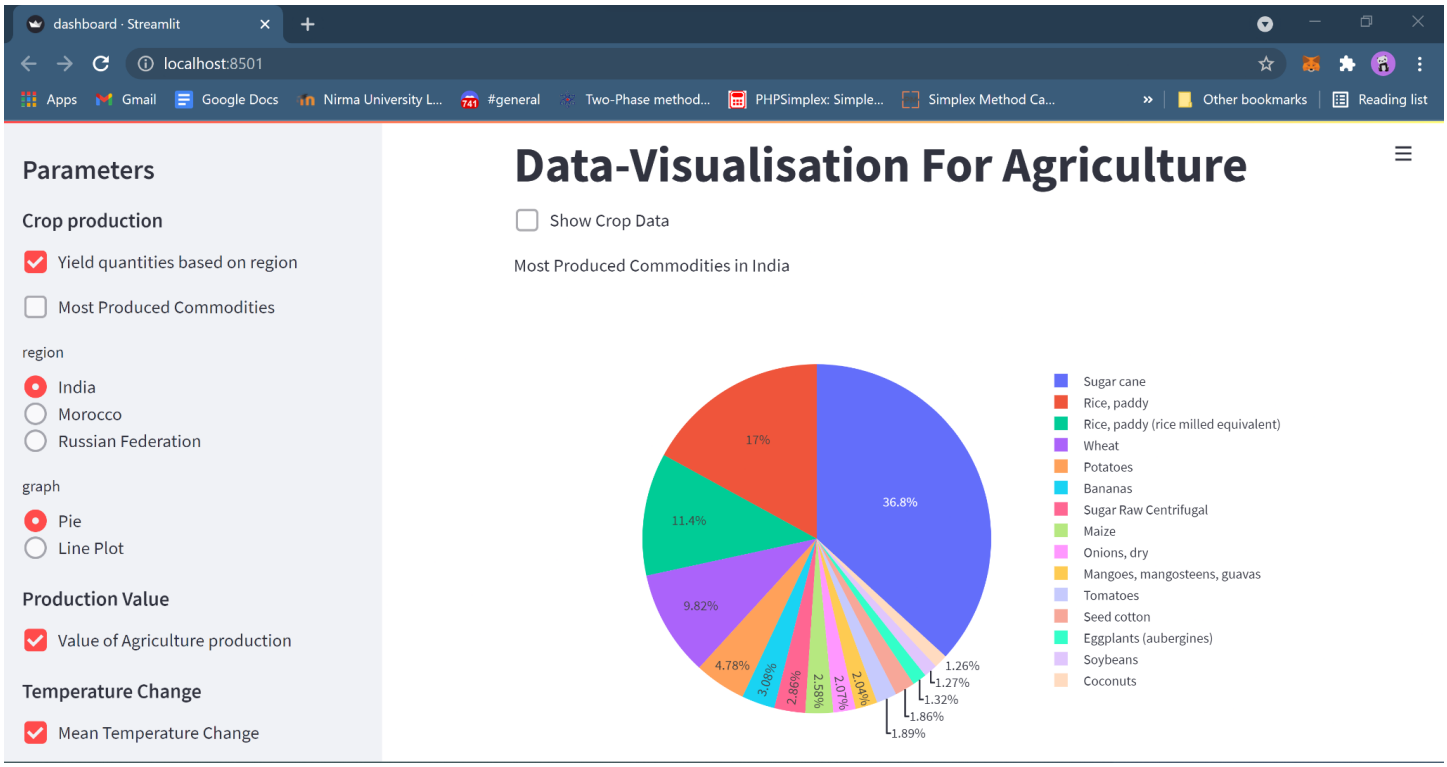

Fig-4 Screenshot of our dashboard showing implementation of first parameter

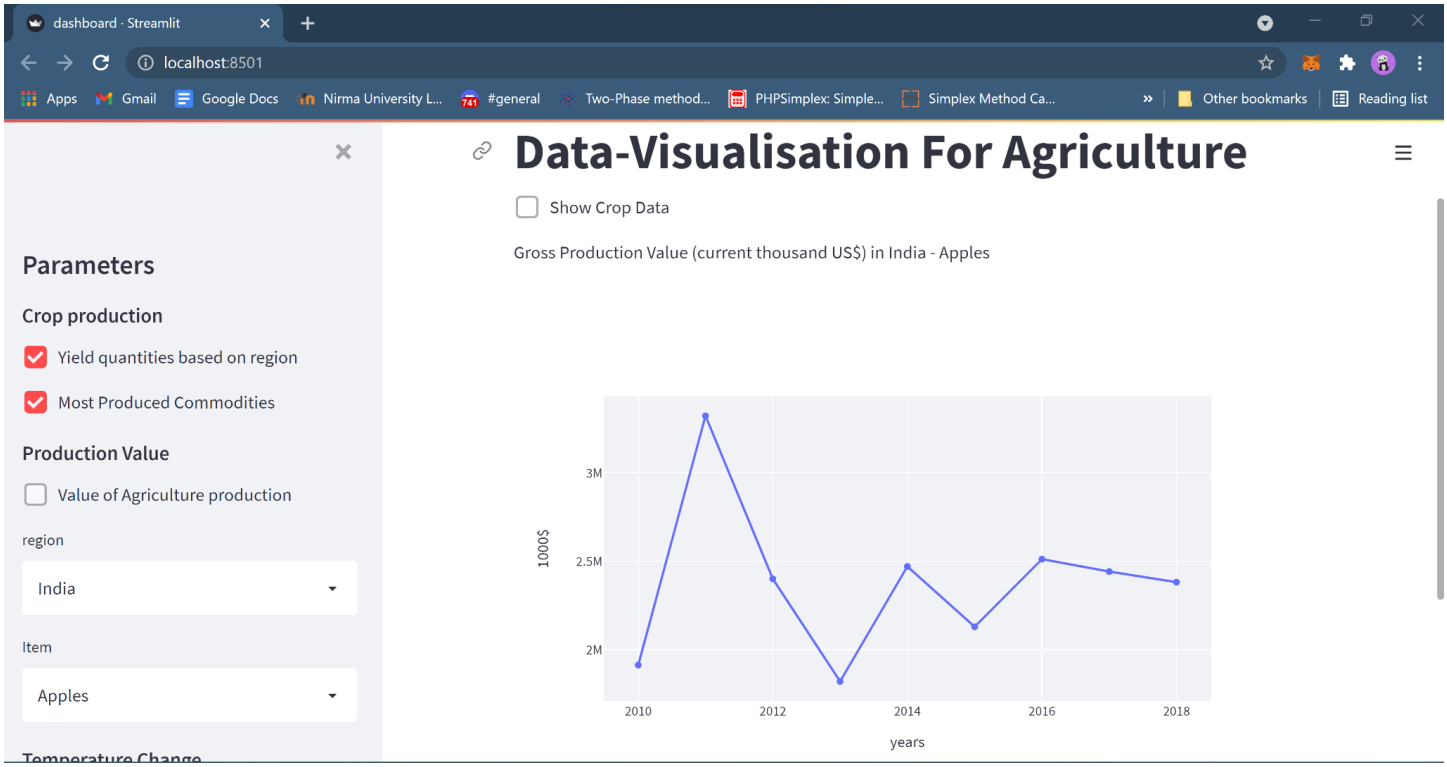

Fig-5 Screenshot of our dashboard showing implementation of second parameter

In the mean temperature change parameter, we can set the month interval for which we want to see the data. In the below image for India, the line plot shows the mean temperature change in the sept-oct-November month from 2010 to 2020.

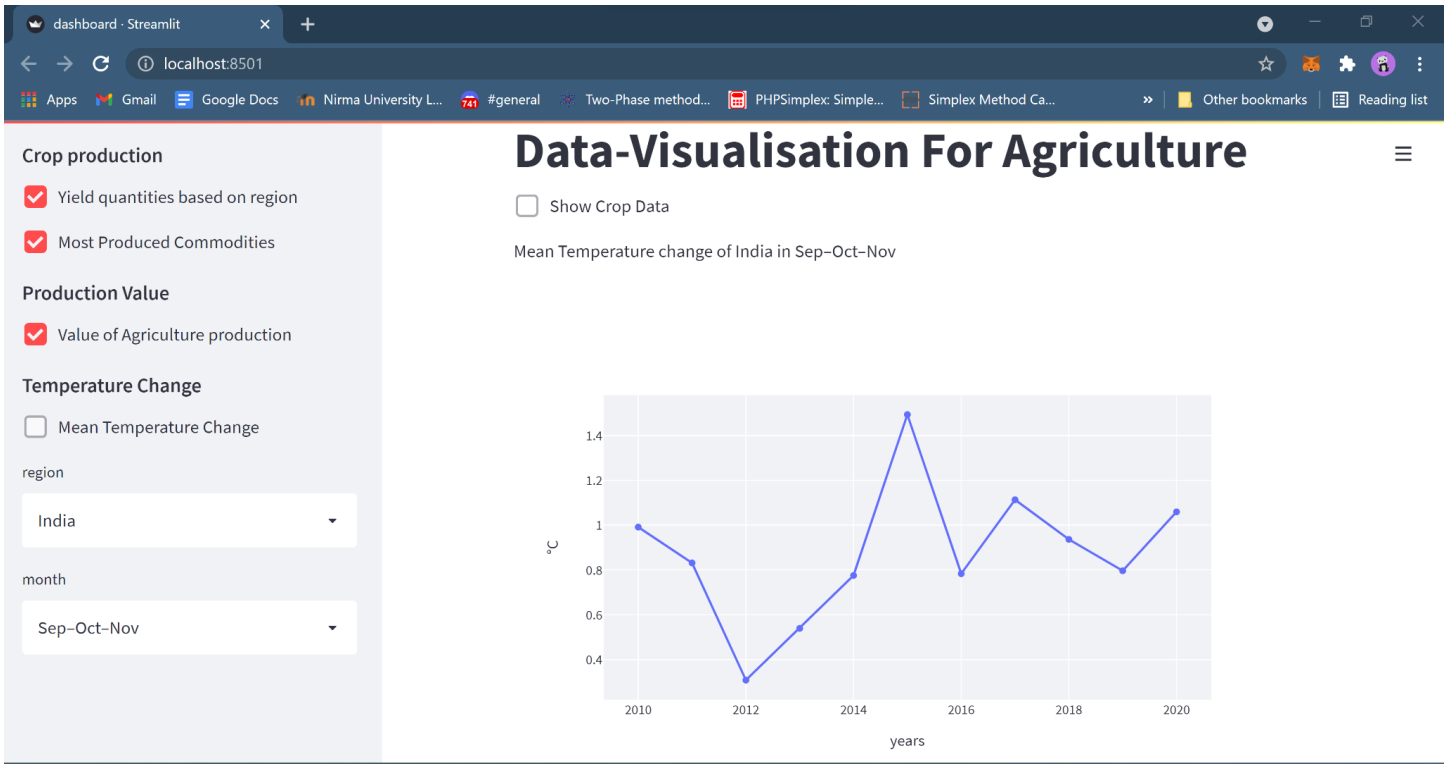

Fig-6 Screenshot of our dashboard showing implementation of third parameter

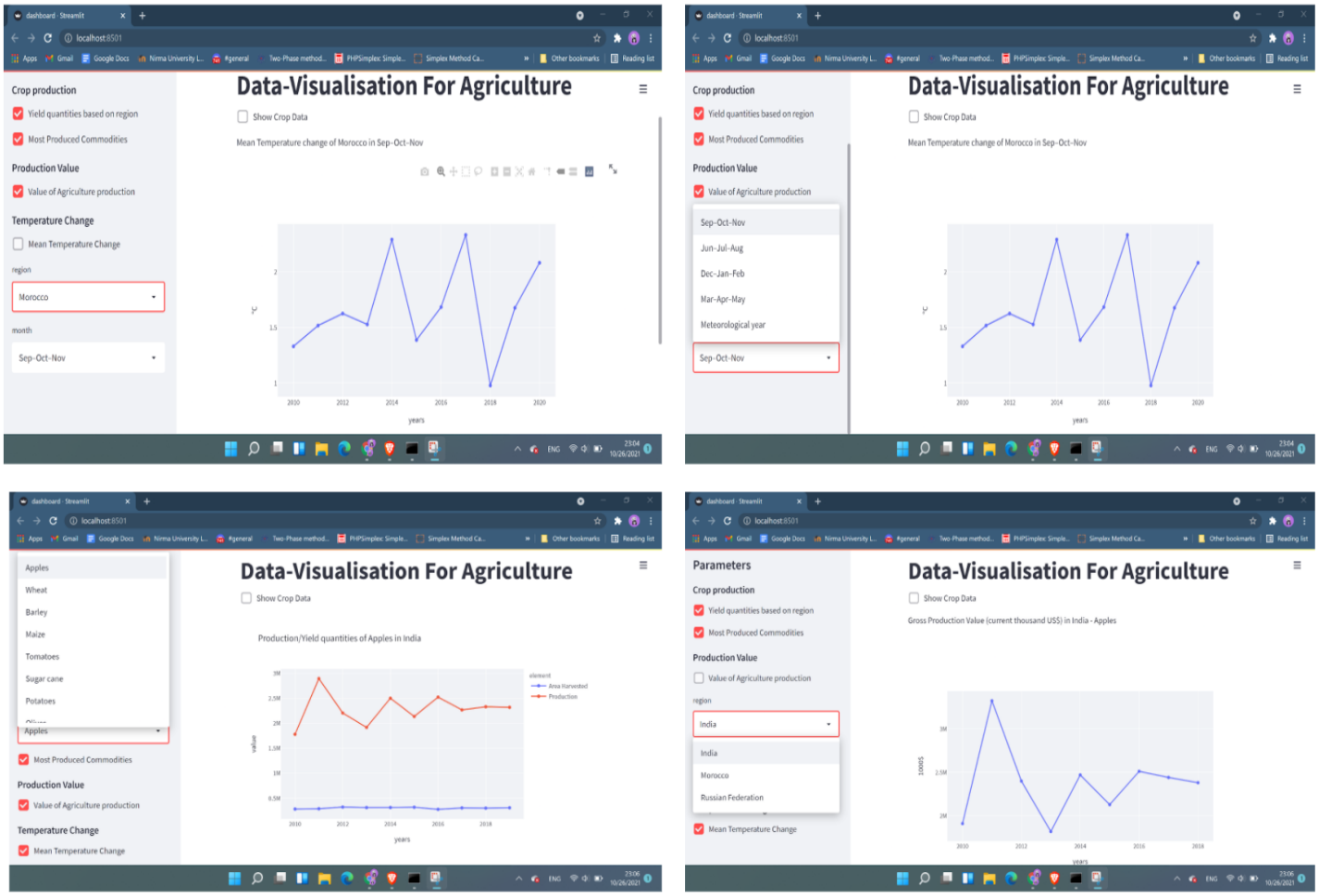

Fig-7 Screenshot of our dashboard showing implementation of all the parameters with drop down list

Chapter 4: RESULTS ANALYSIS

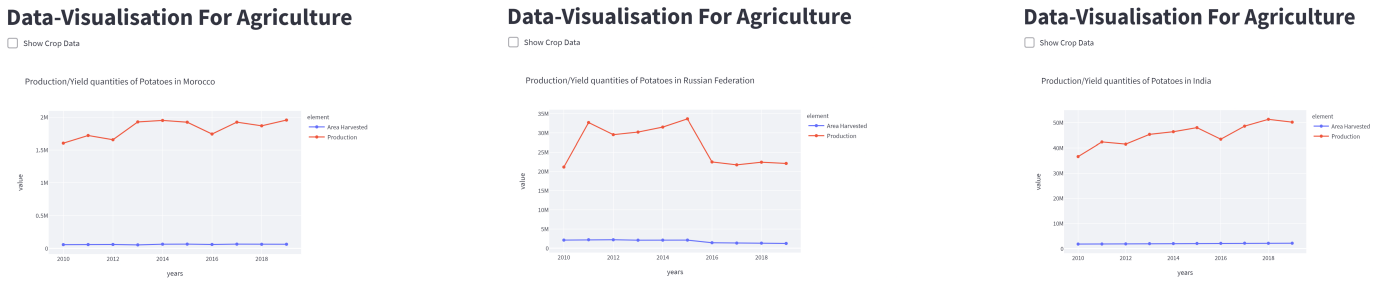

Fig-8 Screenshot of our output

We can see the harvested area for the potatoes in Morocco has not significantly changed whereas there is a change in the production quantity in the other two countries between the years 2010-2020. Moreover, India & Russia being larger countries than Morocco have Area harvested potatoes ten times more than Morocco. Russia and India have roughly the same area of harvest but we can see that Russia has more production than India. Also, as years fly by, more and more potatoes are being harvested by India & Morocco. But there is a significant decline in potato production in Russia after 2014.

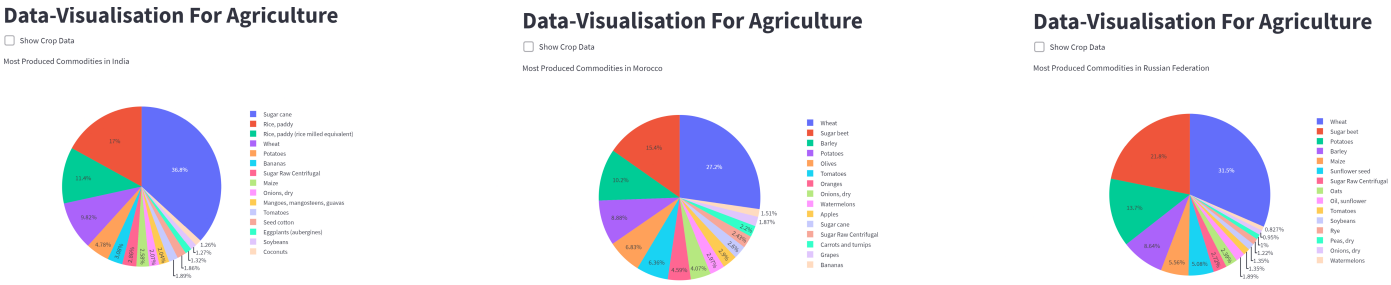

Fig-9 Screenshot of our output

From the given pie chart we can say that India is the highest producer of sugarcane among the other commodities produced in the country. In Morocco, there is high production of wheat followed by Sugar beet. In the Russian Federation, there is a large production of wheat, sugar beet and barley. So, considering this data we can conclude that the appropriate temperature for the production of sugarcane is present in India. Likewise, weather conditions for the production of wheat are present in Morocco and the Russian Federation.

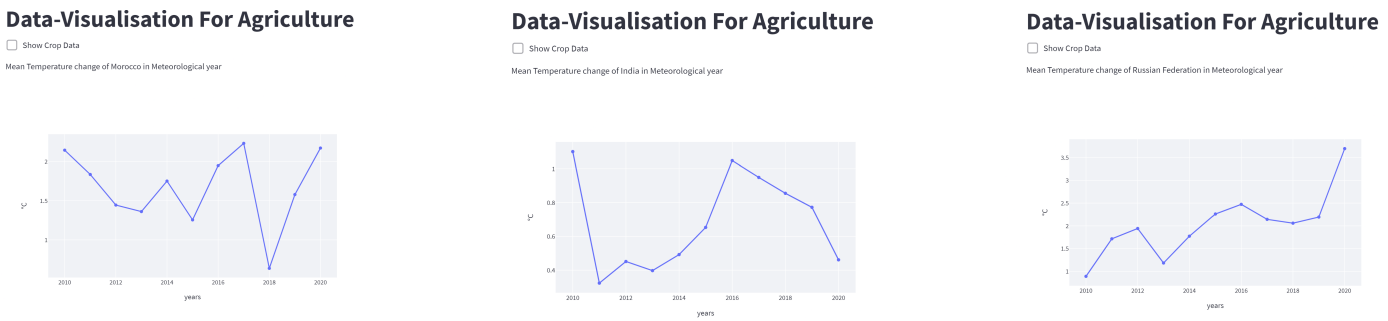

Fig-10 Screenshot of our output

The drastic temperature change leads to decrease in the production of commodities. As we can see that for Morocco, in 2018 when there was a fall in temperature, we had less area harvested. When there was a sudden rise in temperature in India in 2016, there was a drop in the value of the area harvested. So, we can say that an increase in temperature or sudden fall in temperature affects the quantity of production which can be clearly seen from the graphs.

Chapter F: CONCLUSION

From this study, one can easily get insights into the current agriculture status for their country. Building a dashboard can help farmers gain more insights on crop planning and also predict the temperature change the following year. This way they can gain more insights on what crops to grow and at what time. Many more features can be added to this project like deploying it using the domain name, one can also include more datasets. By using machine learning & computer vision, we can also predict crop yield from the given images or drone videos. Our primary main objective of developing is really to increase cultivation effectiveness outcomes and reduce expenses due to cultivation without planning, while still helping the producer with commercial revenues. As a result, it aids in achieving a balance between agriculture production profitability rates and also on the growth rates.

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List of websites

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Additional Material

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