FARMING MADE EASY

USING MACHINE

LEARNING

Minor Project Report

by

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Project Approval Certificate

This is to certify that the Project entitled FARMING MADE EASY USING MACHINE LEARNING has been completed to our satisfaction by Manasi Jadhav, Neha Kolambe, Shreya Jain under the guidance of Sheetal Chaudhari for the award of Degree of Bachelor of Technology in Information Technology from University of Mumbai.

External Examiner **Internal Examiner**

(signature) **(signature)**

Name: **Name:**

Date: **Date:**

Seal of the Institute

Acknowledgments

It is really a pleasure to acknowledge the help and support that has gone to in making this thesis. We express our sincere gratitude to my guide Sheetal Chaudhari for her invaluable guidance. Without her encouragement this work would not be a reality. With the freedom she provided, we really enjoyed working under her. We thank our examiner, ”EXAMINER NAME” for his/her word of advice.

We thank the HOD and staff of the Information Technology Department for giving us all the facilities required to carry out this research work. We would like to thank all our family members and well-wishers for their constant encouragement for all these years, without which we could not have completed this work.

MP REPORT

1. Introduction

1.1. Problem Statement

To build an application that recommends the best fertilizer suited for their crop given the soil, location, and crop details to the user (i.e. farmer). A system that provides a platform where farmers can voice/share their concerns/opinions/problems and help each other in solving the same. A portal to the farmers who can buy the recommended/desired fertilizers and equipment. System that also gives farmer-friendly material (i.e. videos) to help farmers who are new to the agricultural sector in gaining basic knowledge.

1.2. Solution Adequacy

Existing systems consider potato, aus rice, boro rice, wheat, aman rice and jute. Our system will manage 20 types of crops (roughly).
The paper talks about crop yield prediction. Our system will merge the concept with the market data to predict the price of crops, as well as to provide fertilizers consumption based on different crops. It can be deployed in weather forecasting also. Our system will combine together these concepts to make a full - length website which will help farmers.
Existing framework provides a price prediction module which can help farmers to make certain decisions based on the harvested area or current trends in the market. Our system will provide a graphical visualization of predicted prices for better understanding.

1.3. Suggested Solution

The goal is to apply more nutrients than the crop removes so that the nutrient level in the soil is not limiting the yield. The fertilizer recommendations are made to apply enough fertilizers to both meet the nutrient requirements of the crop and to build up the nutrient level in the soil to a critical soil test level over a planned time frame. One of the best benefits of the Shopping Portal is the absence of middlemen that reduces the cost price to a greater degree. Moreover, the online portal is computerized and automated saving a crucial amount of money.
Through a chat portal, multiple users i.e., farmers can connect to discuss their queries.
The farmer will be able to choose the category in which section he wants to browse and watch videos related to that category.

1.4. Constraints & Assumptions

- **Data Collection:** Collecting relevant data that covers a large number of agricultural parameters beneficial for fertilizer recommendation.
- **Clustering:** Making groups (Cluster) of alike research areas so that users can access all of them much more efficiently. For instance, if algorithms is a research area, then all the subparts of algorithms can be clustered together.
- **Recommendation searches:** One of the important challenges that one may encounter is to show recommended articles to a user based on his previous searches.
- **Finding grants or funding institutes:** It is a big challenge to find where the research projects generate the funds for their functioning.
- **Establishing a connection between research companies and students:** We need to establish connections such that if a research project is started by any firm/professor, then students must be notified about the same. Thus a healthy relationship must be established.

1.5. Objective & Scope

- Exact data about the history of harvest yield is significant for settling on choices identified with rural hazard and the executives and future expectations. In the status quo, the farmers and the consumers find it difficult in the real world to determine the accurate prices of crops without having prior knowledge of the fluctuating trend prices or weather conditions.
- The proposed framework targets foreseeing the crops price by learning the previous information of the prices and weather conditions.
- Since the interaction of the farmers is a challenge due to the long distance this system will help them in connecting together. It aims at reducing the cost incurred by the farmer to the end user.
- It will forecast weather using the weather API. This will be a user-friendly project which provides the information guide in regional language
- The system comes with a model to be precise and accurate in predicting crop price and deliver the end-user with proper recommendations about the required fertilizer ratio based on atmospheric and soil parameters of the land which enhances farmer revenue.
- We are also providing a shopbot to buy the recommended fertilizers and the necessary cultivating related items.
- There will be a chatbot where farmers can communicate to tackle their queries. It also aims at reducing the cost incurred by the farmer to the end-user.
- We are providing some informative videos for proper understanding.

2. Literature Survey

The following papers focussed on predicting crop price using Machine Learning and providing results. In April 2019, the exploration targets foreseeing both the cost and benefit of the given harvest before planting.The preparing datasets so acquired give enough bits of knowledge to foresee the suitable cost and request in the business sectors[1]. The authors have predicted the most profitable crops and its expected price during harvesting time according to the location, by predicting different historical raw datasets using different machine learning algorithms. The work demonstrated by Nishiba [2] is the potential use of data mining techniques in predicting the crop yield based on the input parameters average rainfall and area of field. The user-friendly web page developed for predicting crop yield can be used by any user by providing average rainfall and area of that place. Different Data Mining techniques are applied to different datasets. This paper can also include certain modules [11] which can help farmers to make certain decisions based on the harvested area or current trends in the market. The system can be extended by visualizing the crop details in a map with details, which will help farmers to view the nearby district cultivation details. Proposed system can be enhanced by providing a graphical visualization of predicted prices for better understanding.

This system is proposed to provide help to the farmers for expecting the best amount for their crops and for predicting the best price for the crops. This also helps the farmers to check previous prices of different commodities. The system can predict crops using [9] Random forest, Polynomial Regression and Decision Tree algorithms .The best crop and its required fertilizers make the farmer more confident about the crop and its yield and also our system will do marketing work [4] by estimating total value of the crop based on current market price. The idea of the system can be extended by adding some extra features to the system like providing a nearby shop location portal for purchasing seeds and fertilizers.

These papers aim at predicting the price and forecast through web application and it runs on efficient machine learning algorithms like using an Autoregressive Integrated Moving Average (ARIMA) model,Traditional ARIMA [6], Support Vector Regression Algorithm[8], and technologies having an overall user-friendly interface to the users.The training datasets [7] obtained provide enough insights for predicting the appropriate price [10] and demand in the markets. The results are displayed as web applications in order that poor farmers can access easily. Models can be improved by integrating this with other departments like horticulture, sericulture, and others towards the agricultural development of our country. Different agriculture departments have various

problems in the current time. Incorporating them will not only increase the scope but also help the farmers new to this part of the spectrum. This research work can be enhanced to the high level by building a recommender system of agriculture production and distribution for farmers. By which farmers can make their own decision like which season which crop should sow so that they can get better profit. We can try applying a data independent system. Irrespective of the format, our system should work with the same accuracy. Further, can be enhanced by making an android application for the same.

3. Analysis

3.1. User Stories & Priorities

- As a new farmer, I want to learn about current trends used in farming so that I have prior knowledge about basic things.

  Acceptance Criteria: At the time of usage, the user will know the top 3 and bottom 3 crops according to their previous and predicted prices.

  Priority: 1

- As a farmer, I want to know the price of my crop beforehand so that I can have effective farm management.

  Acceptance Criteria: For price prediction users will provide crop name and accordingly prediction for the next 6 months will be displayed.

  Priority: 2

- As a farmer, I want to know about the weather beforehand, so that I can make decisions accordingly.

  Acceptance Criteria: At the time of usage, the user's location will be stored, and accordingly the weather will be predicted.

  Priority: 3

- As a farmer, I want to know the best fertilizer available for my crop so that I can buy them at a reasonable price

  Acceptance Criteria: At the time of recommendation for fertilizers, the user will provide crop name, location, and soil type.

  Priority: 4

- As a farmer, I want to find products that I need, in one place so that I don't move around a lot for a great deal

  Acceptance Criteria: At the time of purchasing fertilizers or seeds, the user will provide the city and accordingly the nearby shop's name along with the address will be displayed on the map.

  Priority: 5

- As a farmer, I want to talk to my fellow mates so that I hear about problems faced by them while I share mine.

Acceptance Criteria: At the time of registration, the name of the farmer will be stored.

Priority: 6

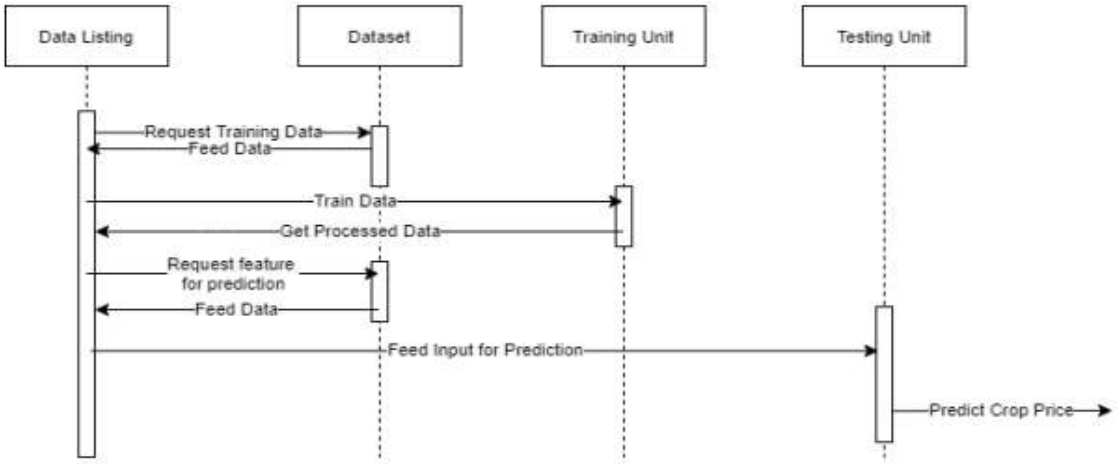
- As a new farmer, I want to know about the best suited crop for my land so that I can produce maximum yield and profit.

  Acceptance Criteria: At the time of usage, the user will know the list of crops provided by the system along with their details.

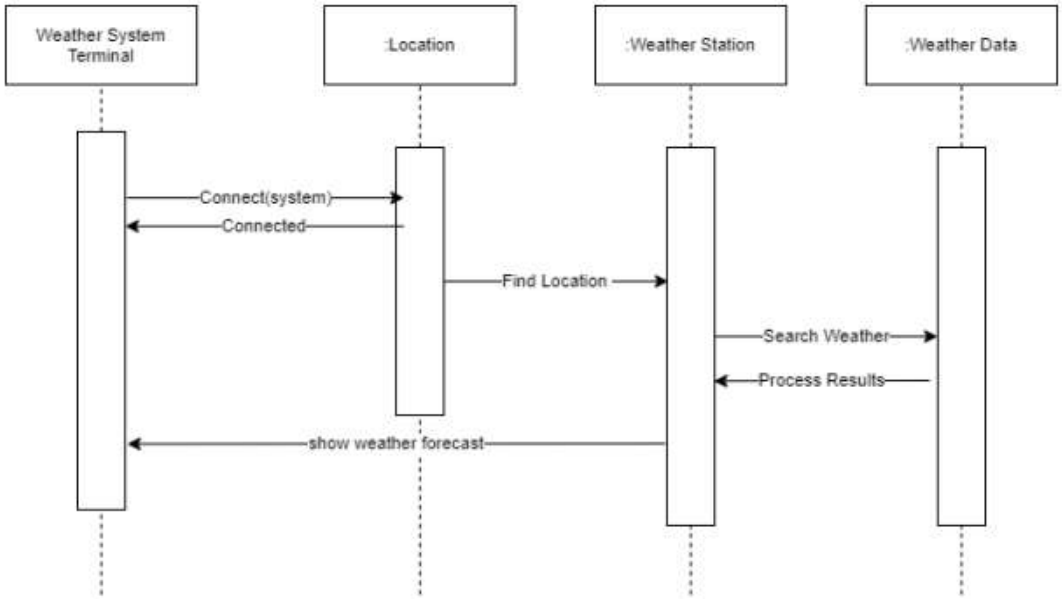
  Priority: 7

3.2. Sequence Diagrams

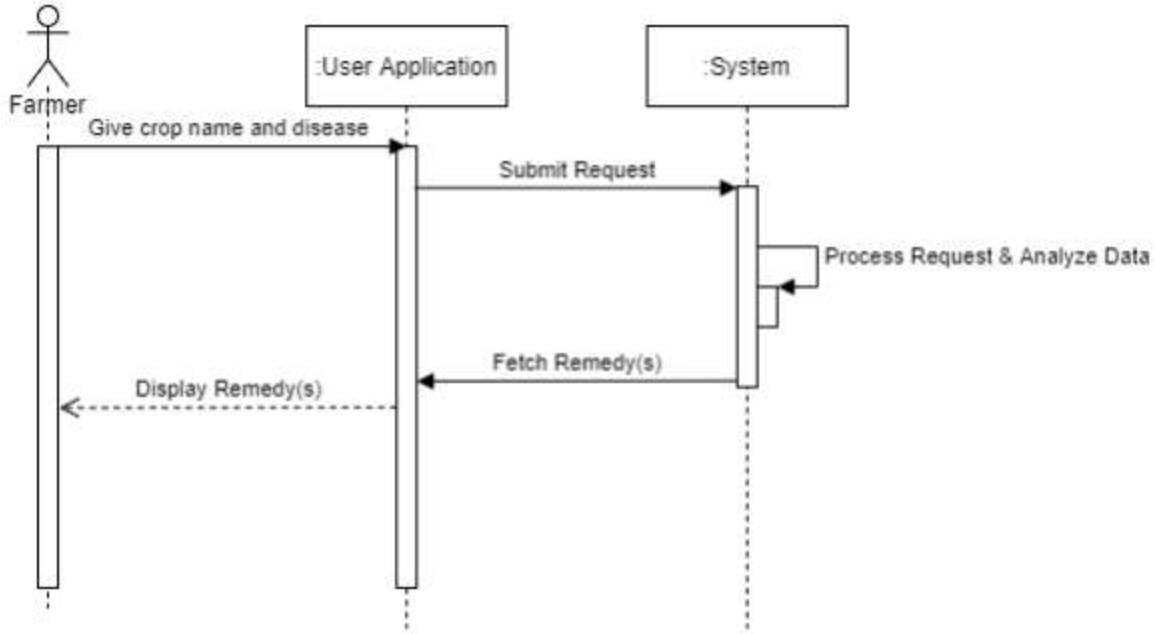
Crop Price Prediction



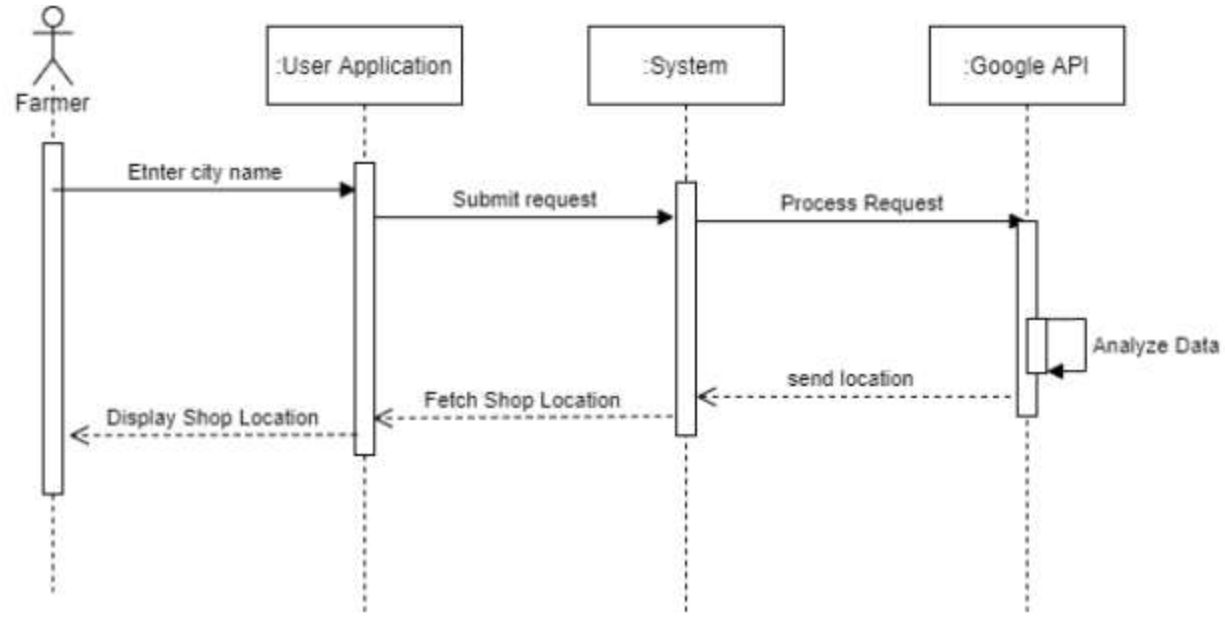
Weather Forecast



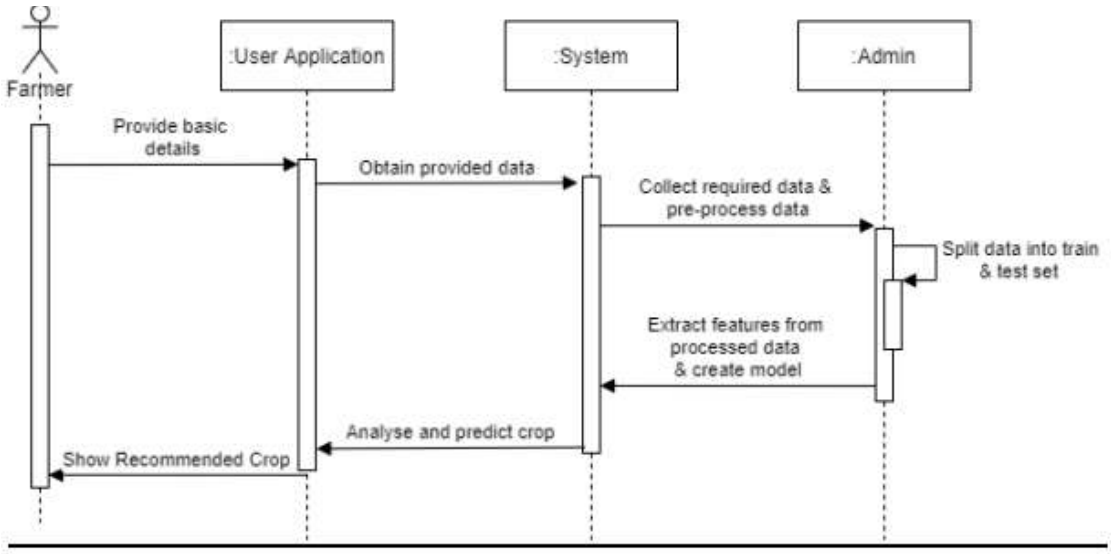
Fertilizer Recommender



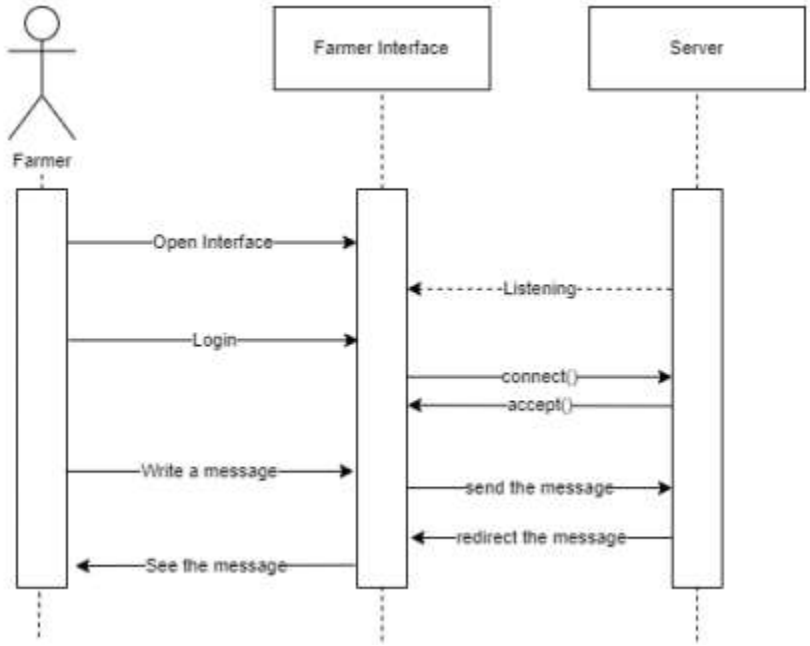
Fertilizer Shopping Portal



Crop Recommender

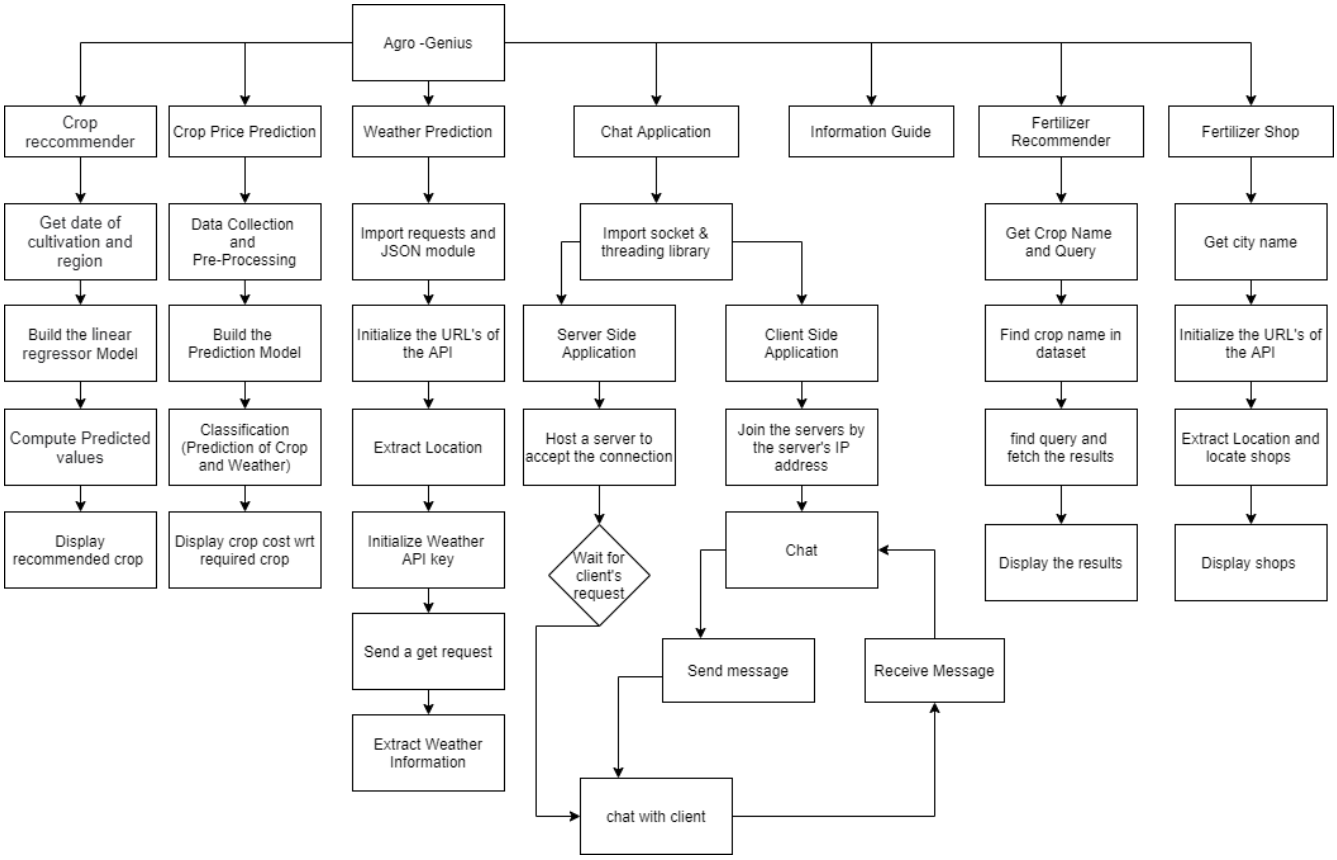


Chat Application



4. Design

4.1. Flow Diagram



4.2. Technical Specification for User Stories

ID	User Stories	Technical Stories
1	As a farmer, I want to know the best fertilizer available for my crop so that I can buy them at a reasonable price	Create a Recommendation model based on crop name, soil type, and current location.
2	As a farmer, I want to know the price of my crop beforehand so that I can have effective farm management.	Creating a Prediction model considering parameters like a month, year, rainfall, and wholesale price index and accordingly prediction for the next 6 months will be displayed.
3	As a farmer, I want to talk to my fellow mates so that I hear about problems faced by them while I share mine.	Create a chat portal for interaction between farmers. At the time of registration, the name of the farmer will be stored and then he will be directed to a chat room.

4	As a farmer, I want to find products that I need, in one place so that I don't move around a lot for a great deal	Create a shopping portal where farmers can shop farming -related products like fertilizers, various seeds, etc.
5	As a new farmer, I want to know about the best suited crop for my land so that I can produce maximum yield and profit.	Create a Crop recommender where farmers can get the best suited crop for their land.
6	As a farmer, I want to know about the weather beforehand, so that I can make decisions accordingly	Create a weather prediction portal using the weather API
7	As a new farmer, I want to learn about current trends used in farming so that I have prior knowledge about basic things.	Providing a section that forecasts the varying trends in the price of the crops.

4.3. Technology Stack

1. Crop Price Prediction
    - Python (3.0 or above)
    - Scikit-learn
    - HTML
    - CSS
    - JavaScript
2. Weather forecasting
    - API for weather = https://openweathermap.org/
3. Crop Recommender
    - Python (3.0 or above)
    - HTML, CSS
    - JS
    - Flask
4. Fertilizer Recommendation
    - Python (3.0 or above)
    - HTML, CSS
    - JS
    - Flask
5. Shopping Portal
    - HTML
    - CSS
    - Bootstrap
    - JS
    - Flask

6. Chat Application:
    - Flask
    - Socket Programming
    - Python (3.0 or above)
7. Information Guide
    - Bilingual guide book = http://agricoop.gov.in/sites/default/files/FFH201819_BiLing.pdf

5. Implementation

5.1. Code

Crop Price Prediction

```
class Commodity:
    def __init__(self, csv_name):
        self.name = csv_name
        dataset = pd.read_csv(csv_name)
        self.X = dataset.iloc[:, :-1].values #extracting rows using pandas
        self.Y = dataset.iloc[:, 3].values
        # Fitting decision tree regression to dataset
        from sklearn.tree import DecisionTreeRegressor
        depth = random.randrange(7,18) #returns a random depth of the tree
from the specified range
        self.regressor = DecisionTreeRegressor(max_depth=depth)
        self.regressor.fit(self.X, self.Y) #fit() method takes the training data as
arguments

    def getPredictedValue(self, value):
        if value[1]>=2019:
            fsa = np.array(value).reshape(1, 3)
            #Convert the following 1-D array into a 2-D array.
            #The outermost dimension will have 1 array, each with 3 elements.
            return self.regressor.predict(fsa)[0]
        else:
            c=self.X[:,0:2]
            x=[]
            for i in c:
```

```
            x.append(i.tolist())
        fsa = [value[0], value[1]]
        ind = 0
        for i in range(0,len(x)):
            if x[i]==fsa:
                ind=i
                break
        return self.Y[i]

    def getCropName(self):
        a = self.name.split('.')
        return a[0]
```

Weather Prediction

```
@app.route('/weather',methods=['GET'])
def weather():
    cityname = request.args.get('city')
    context = {
        "weatherdesc":  weatherf(cityname)
    }
    return render_template('weather.html',context = context)

def weatherf(cityname):
    import socket
    import requests
    try:
        send =[]
        socket.create_connection( ("www.google.com",80) )
        city = cityname
        if(cityname == None):
            pass
        else:
            a1 =
"http://api.openweathermap.org/data/2.5/forecast?units=metric"
            a2 = "&q=" + city
```

```
            a3 = "&appid=c6e315d09197cec231495138183954bd"
            api_address = a1 + a2 + a3
            res1=requests.get(api_address)
            data = res1.json()
            list1 = data['list']
            res = [sub['main'] for sub in list1]
            temp = [t['temp'] for t in res]
            hum = [t['humidity'] for t in res]
            mini = [t['temp_min'] for t in res]
            maxim = [t['temp_max'] for t in res]
            time = [sub['dt_txt'] for sub in list1]
            degree_sign = u"\N{DEGREE SIGN}" + "C"
            weather = [sub['weather'] for sub in list1]
            weatherm,weatherd,icon = [],[],[]
            for i in range(len(temp)):
                for sub in weather[i]:
                    weatherm.append(sub['main'])
                    weatherd.append(sub['description'])
            send.append([time,temp,mini,maxim,hum,weatherm,weatherd])
    except KeyError as k:
        print("City Not Found")
    except OSError as e:
        print("check network ",e)
    return send
```

Chat Application

```
@app.route('/chat')
def sessions():
    return render_template('session.html')
@socketio.on('my event')
def handle_my_custom_event(json, methods=['GET', 'POST']):
    print('received my event: ' + str(json))
    socketio.emit('my response', json, callback=messageReceived)
```

Crop Recommendation

```
@app.route('/croprecomd')
def crop_recommend():
    return render_template('croprecom.html')

@app.route('/predict',methods=['POST'])
def predict():
    '''
    For rendering results on HTML GUI
    '''
    feature = []
    for x in request.form.values():
        feature.append(x)

    pickle_out = open("feature.pickle","wb")
    pickle.dump(feature, pickle_out)
    pickle_out.close()

    #final_features = [np.array(int_features)]
    #prediction = model.predict(final_features)

    croprecomend.apply()
    pickle_in = open("model_output.pickle","rb")
    output = pickle.load(pickle_in)
    avail = str(output[0])
    high = str(output[1])
    rec = str(output[2])
    low = str(output[3])
    day = str(output[4])
    month = int(output[5])
    if(month == 1):
        month = "January."
    elif(month==2):
        month = "February."
```

```
    elif(month==3):
        month = "March."
    elif(month==4):
        month = "April."
    elif(month==5):
        month = "May."
    elif(month==6):
        month = "June."
    elif(month==7):
        month = "July."
    elif(month==8):
        month = "August."
    elif(month==9):
        month = "September."
    elif(month==10):
        month = "October."
    elif(month==11):
        month = "November."
    else:
        month = "December."

    day = day + ', '+ month
    loc = str(output[6])
    avail = avail.translate({ord(i): None for i in "{}""})
    high = high.translate({ord(i): None for i in "[]""})
    rec = rec.translate({ord(i): None for i in "[]""})
    low = low.translate({ord(i): None for i in "[]""})


    #return render_template('index.html', Avail='AC: {}'.format(output[0]),
High ='H: {}'.format(output[1]), avg ='A: {}'.format(output[2], low ='N:
{}'.format(output[3])))
    return render_template('croprecom.html', Avail=avail, Low=low,
High=high, Rec=rec,Day = day,Loc = loc)
```

Fertilizer Shop

```
@app.route('/shop',methods=['POST','GET'])
def shop():
    if request.method == 'POST':
        city = request.form['city']
        print(city)

        return render_template('fertilizer_shop.html',city=city,data=True)

    return render_template('fertilizer_shop.html')
```

Fertilizer Recommender

```
@app.route('/fertilizer_info',methods=['POST','GET'])
def fertilizer_info():
    data = pd.read_csv('static/final_fertilizer.csv')
    crops = data['Crop'].unique()

    if request.method == 'GET':
        crop_se = request.args.get('manager')
        query = data[data['Crop']==crop_se]
        query = query['query'].unique()
        queryArr = []
        if len(query):
            for query_name in query:
                queryObj = {}
                queryObj['name'] = query_name
                print(query_name)
                queryArr.append(queryObj)
            return
jsonify({'data':render_template('fertilizer.html',crops=crops,crop_len=len(cr
ops)),'query':queryArr})

    if request.method == 'POST':
        crop_name = request.form['crop']
```

```
        query_type = request.form['query']
        query = data[data['Crop']==crop_name]
        answer = query[query['query']== query_type]
        answer = answer['KCCAns'].unique()
        protection = []
        for index in answer:
            protection.append(index)

        return
render_template('fertilizer.html',protection=protection,protection_len=len(pr
otection),display=True,crops=crops,crop_len=len(crops))


    return
render_template('fertilizer.html',crops=crops,crop_len=len(crops),query_le
n=0)
```

Current Trends

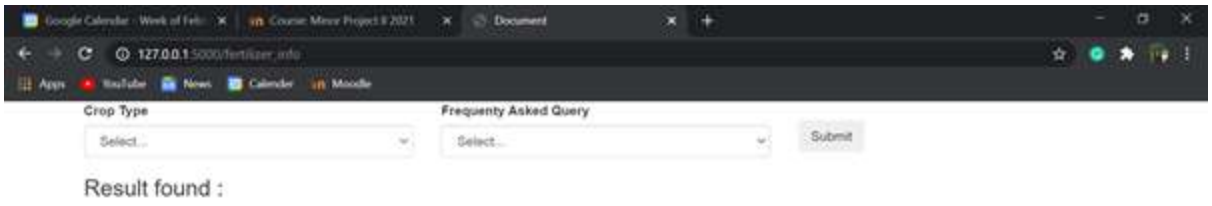
```
@app.route('/')
def index():
    return render_template('index1.html')

@app.route('/trends')
def trends():
    context = {
        "top3": TopThreeWinners(),
        "bottom3": TopThreeLosers(),
        "sixmonths": SixMonthsForecast()
    }
    return render_template('trends.html', context=context)
```

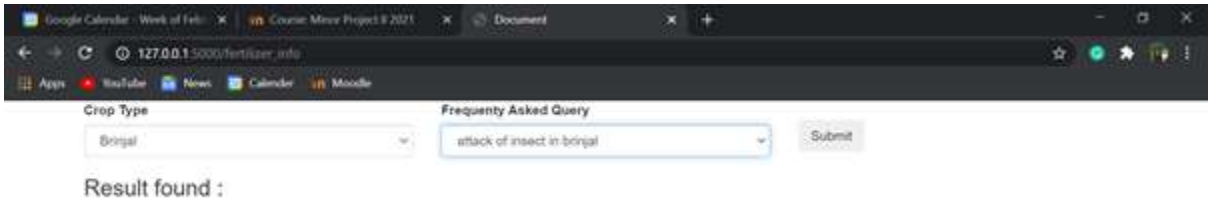
Information Guide

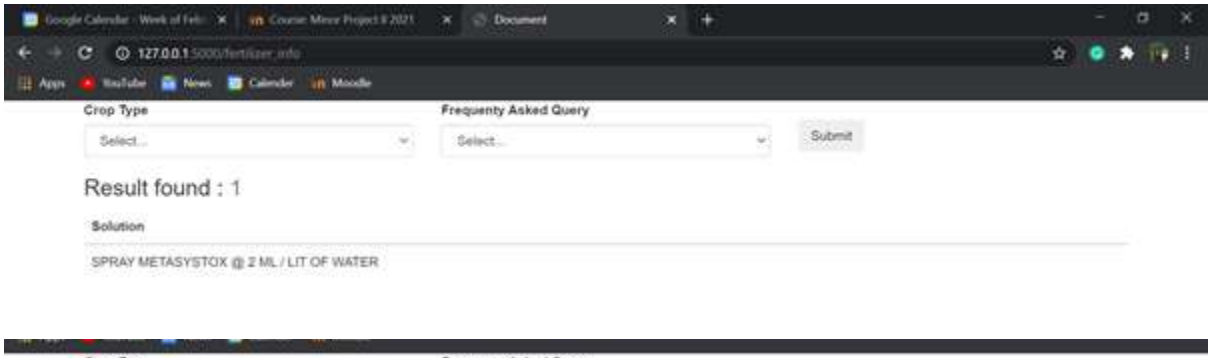
```
@app.route('/guide')
def guide():
    return render_template('guide.html')
```

5.2. Test cases

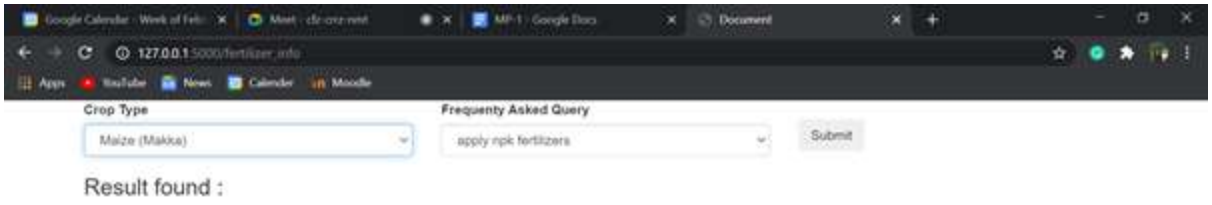
1. In Fertilizer Information Page, if result if found it shows the result, otherwise it shows Result found 0

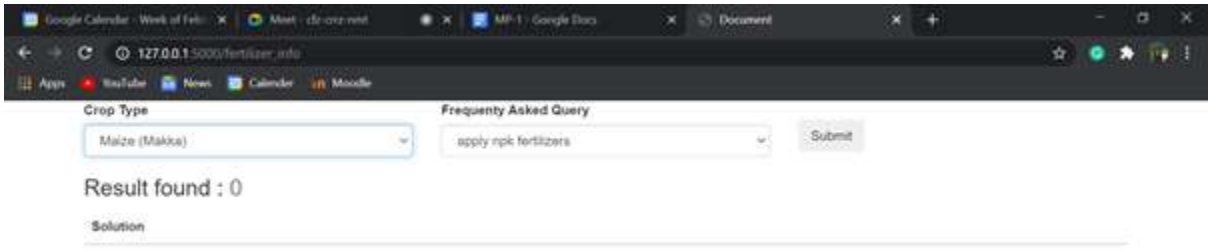




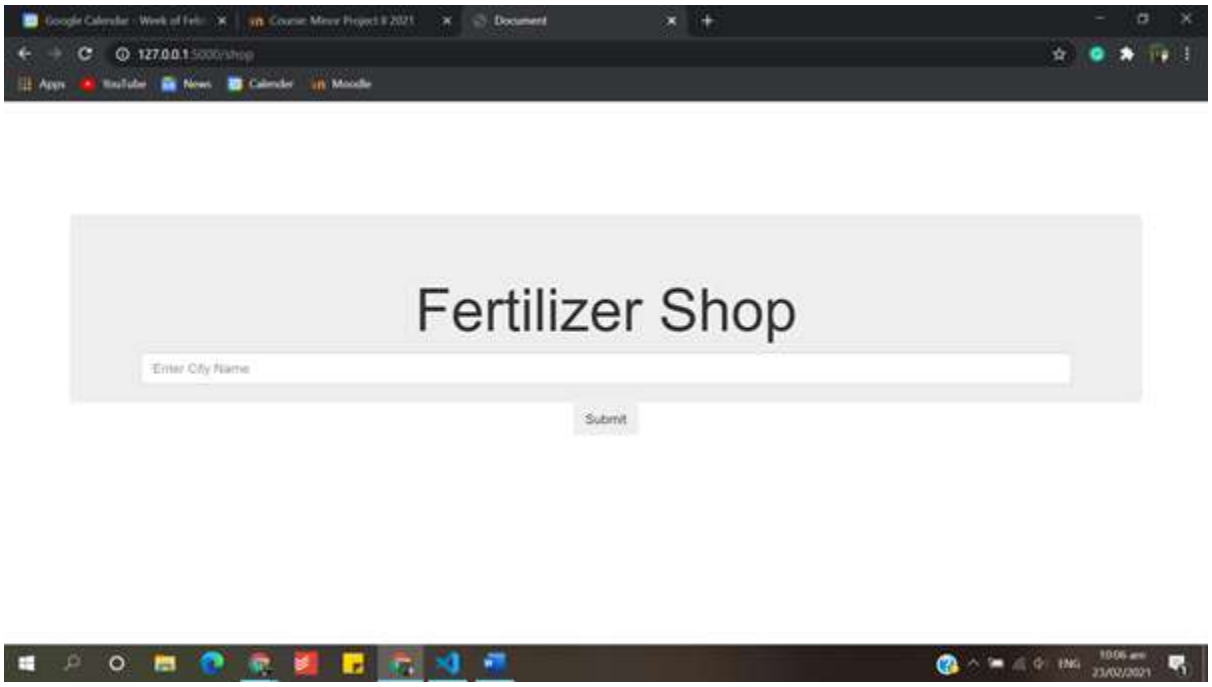


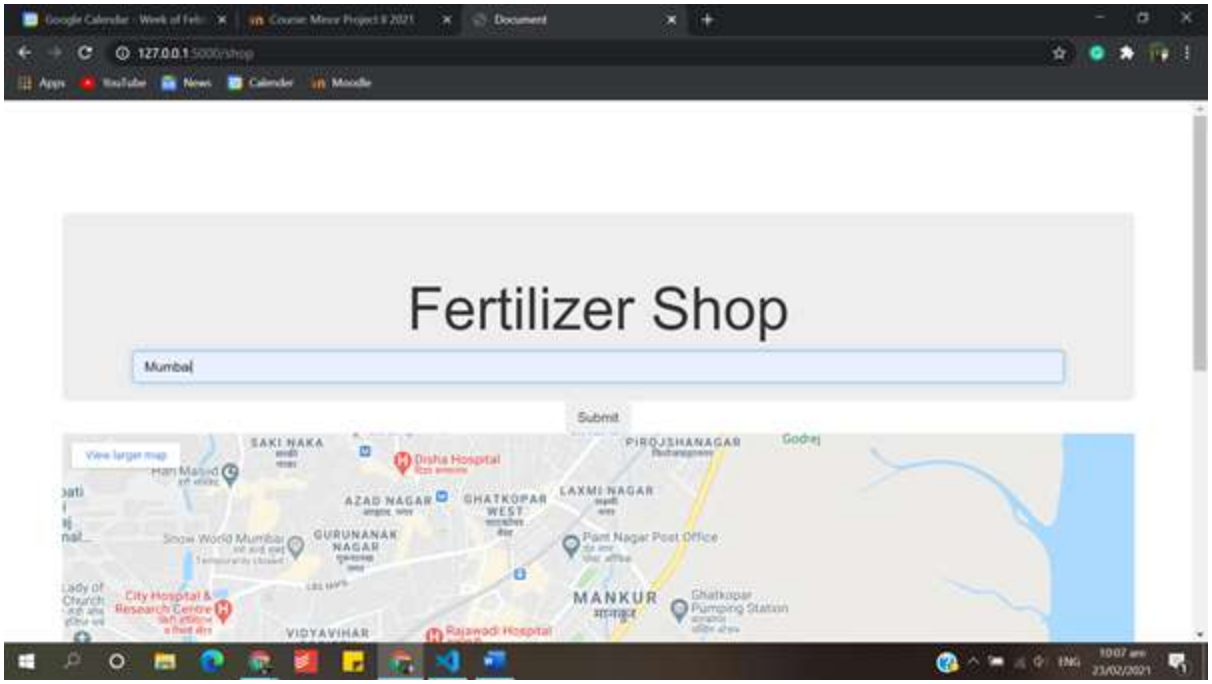
2. In the Fertilizer Information Page, if result is not found, it shows Result found 0.





3. Enter City name to get nearby fertilizers and seed shop




Google Calendar - Week of Feb
Course: Minor Project II 2021
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Moodle
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Mumbai
Submit
View larger map
SAKI NAKA
Disha Hospital
PIROJSHANAGAR
AZAD NAGAR
GHATKOPAR WEST
LAXMI NAGAR
Snow World Mumbai
GURUNANAK NAGAR
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City Hospital & Research Centre
MANKUR
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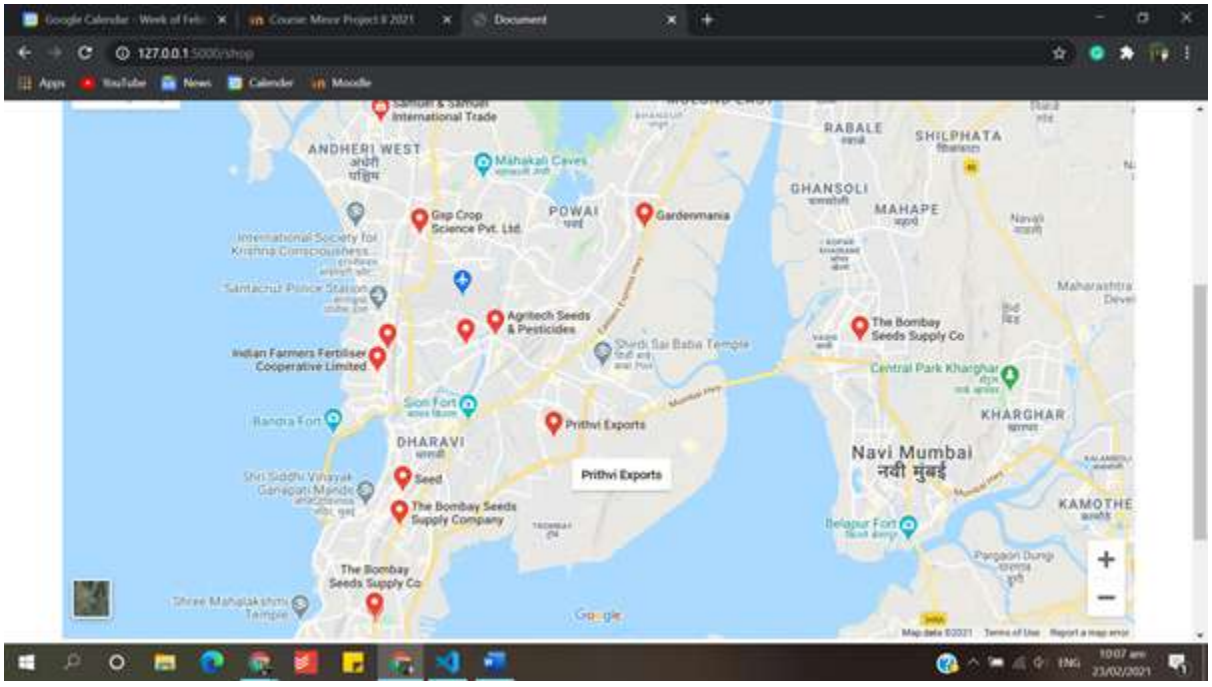
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Mahakali Caves
RABALE
SHILPHATA
GHANSOLI
MAHAPE
POWAI
Gardenmania
Gsp Crop Science Pvt. Ltd.
International Society for Krishna Consciousness
Santacruz Police Station
Agritech Seeds & Pesticides
The Bombay Seeds Supply Co
Indian Farmers Fertiliser Cooperative Limited
Shirdi Sai Baba Temple
Central Park Kharghar
Sion Fort
Prithvi Exports
KHARGHAR
Bandra Fort
DHARAVI
Navi Mumbai
नवी मुंबई
Seed
Prithvi Exports
Shri Siddhi Vinayak Ganapati Mandir
The Bombay Seeds Supply Company
KAMOTHE
Belapur Fort
The Bombay Seeds Supply Co
Shree Mahalakshmi Temple
Google
Map data ©2021
Terms of Use
Report a map error
ENG
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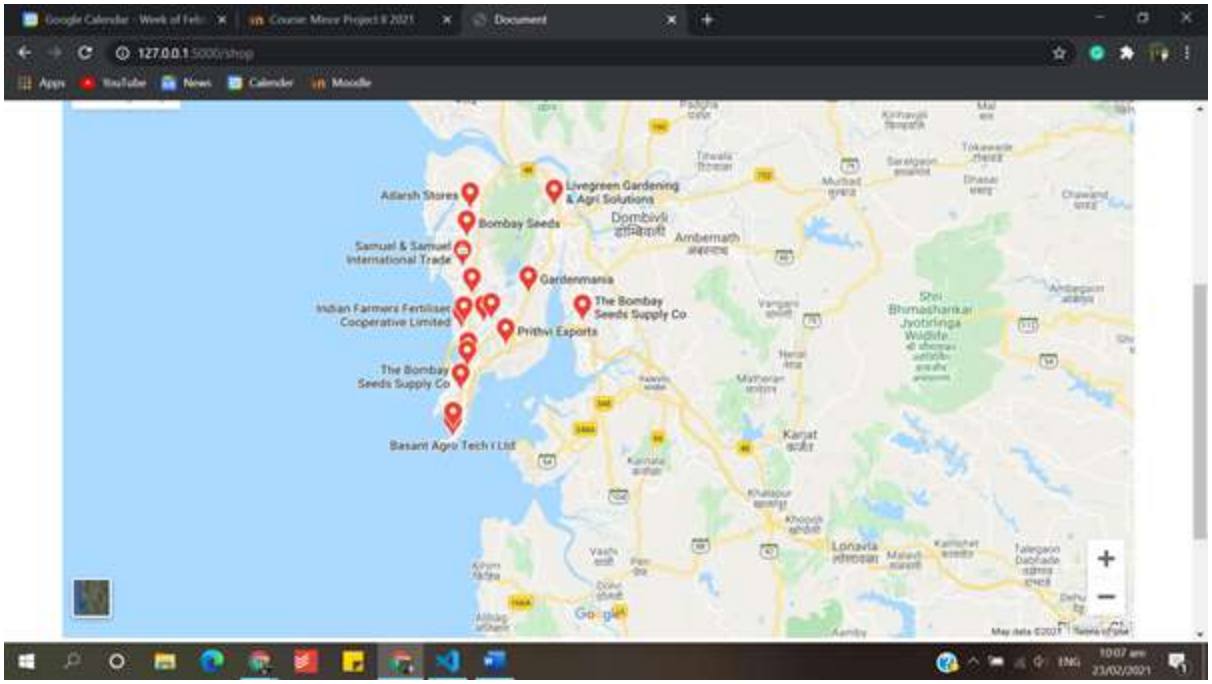
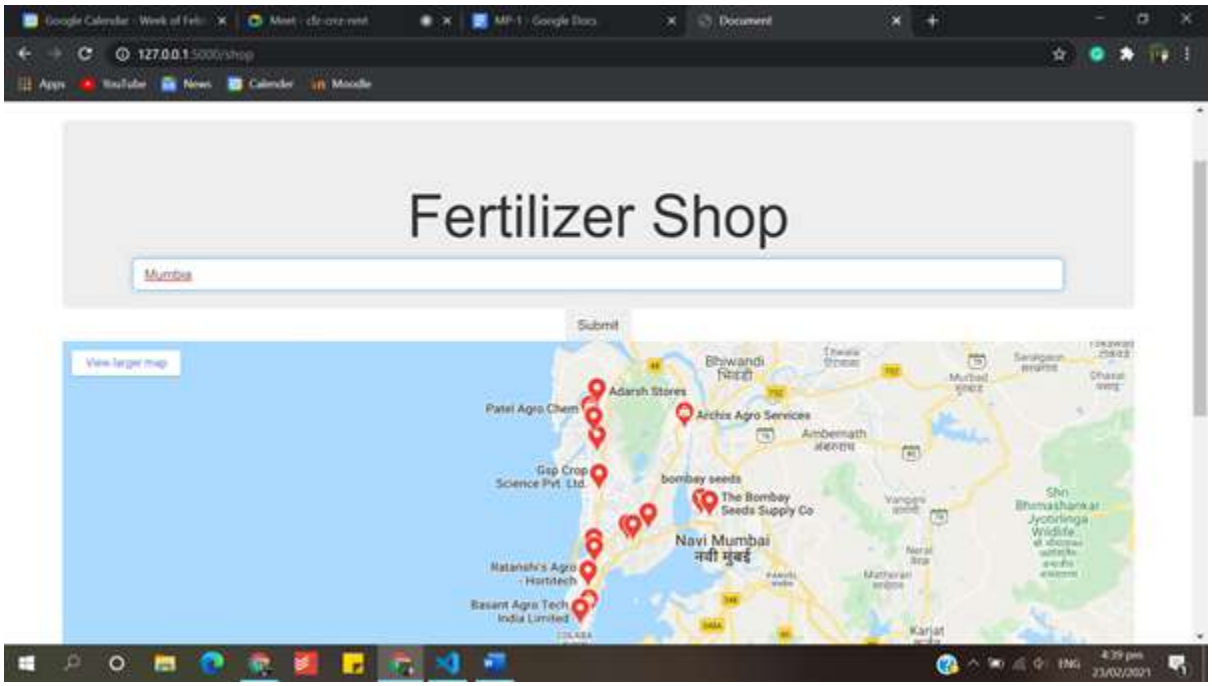
21/02/2021

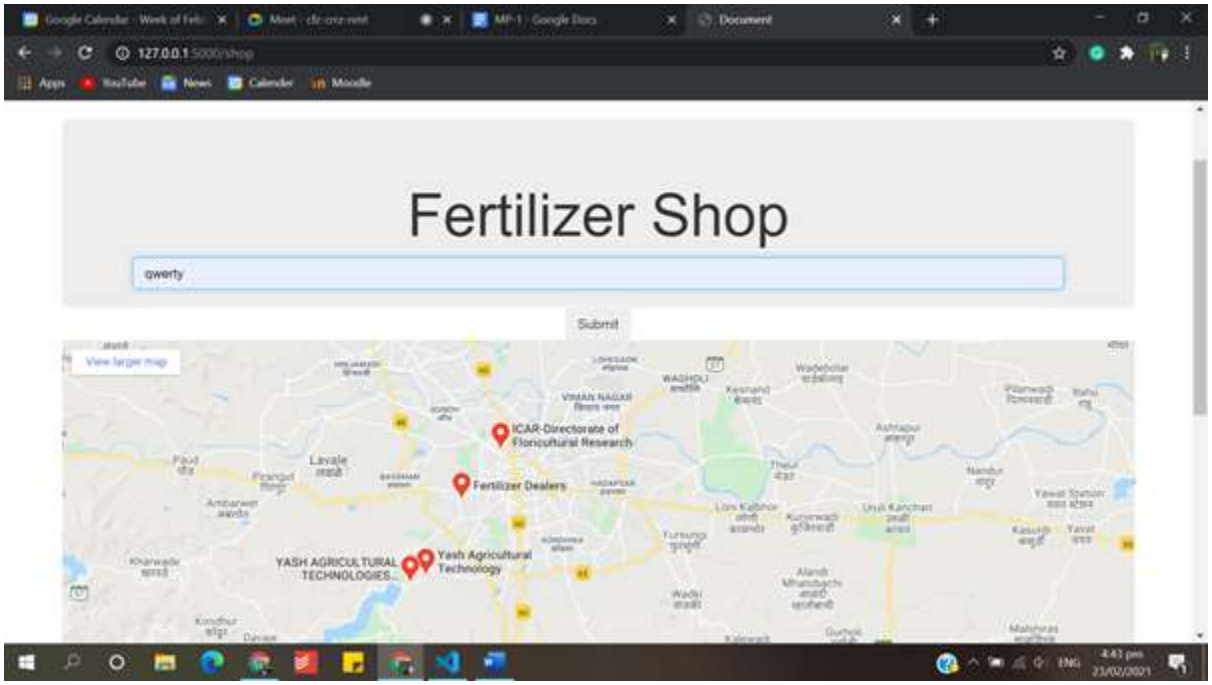


4. If the entered city name is wrong, it will search the city whose name is approximately similar to the entered city name.

   Here I entered Mumbai which is similar to Mumbai so the shops in Mumbai are displayed.



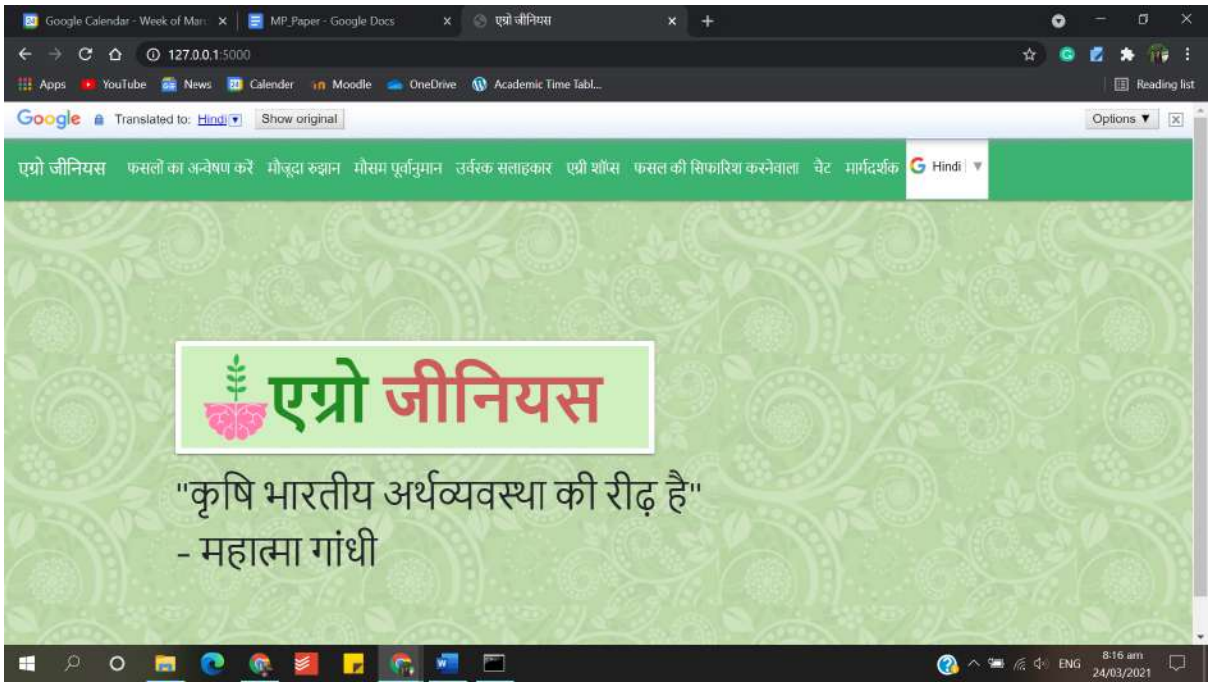
5. Here, I am entering the city name which is not at all valid then it shows some values rather than displaying nothing on the map.



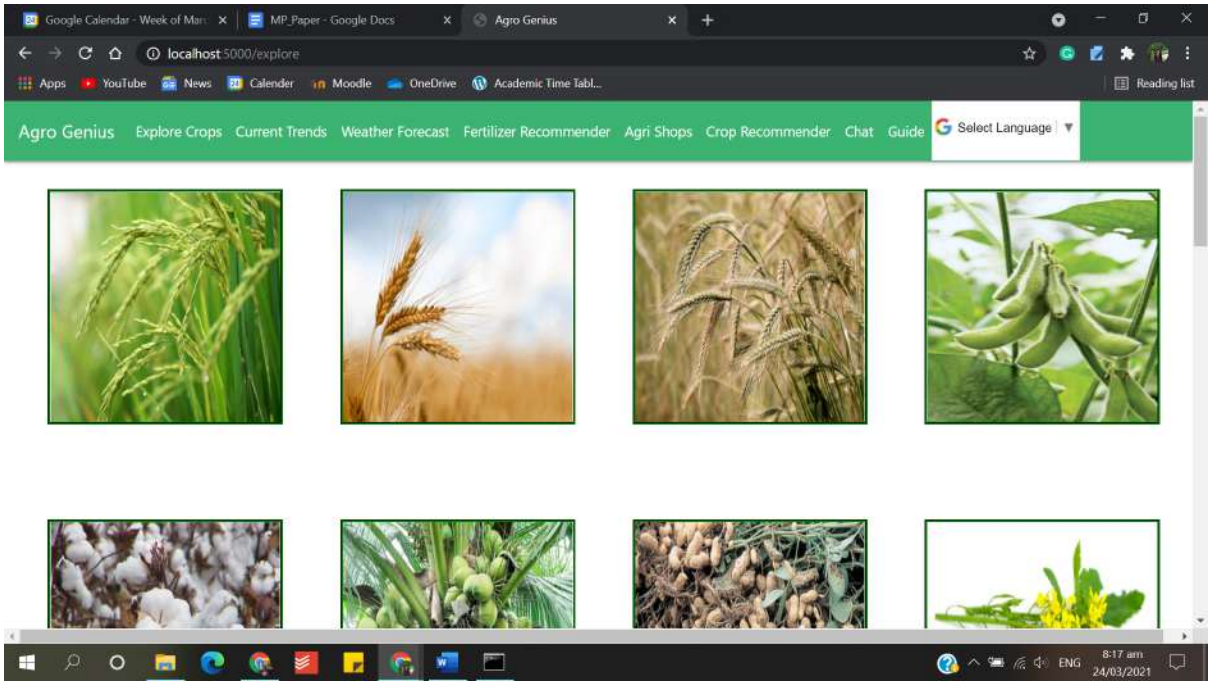
5.3. Continuous Integration Testing

Home Page:

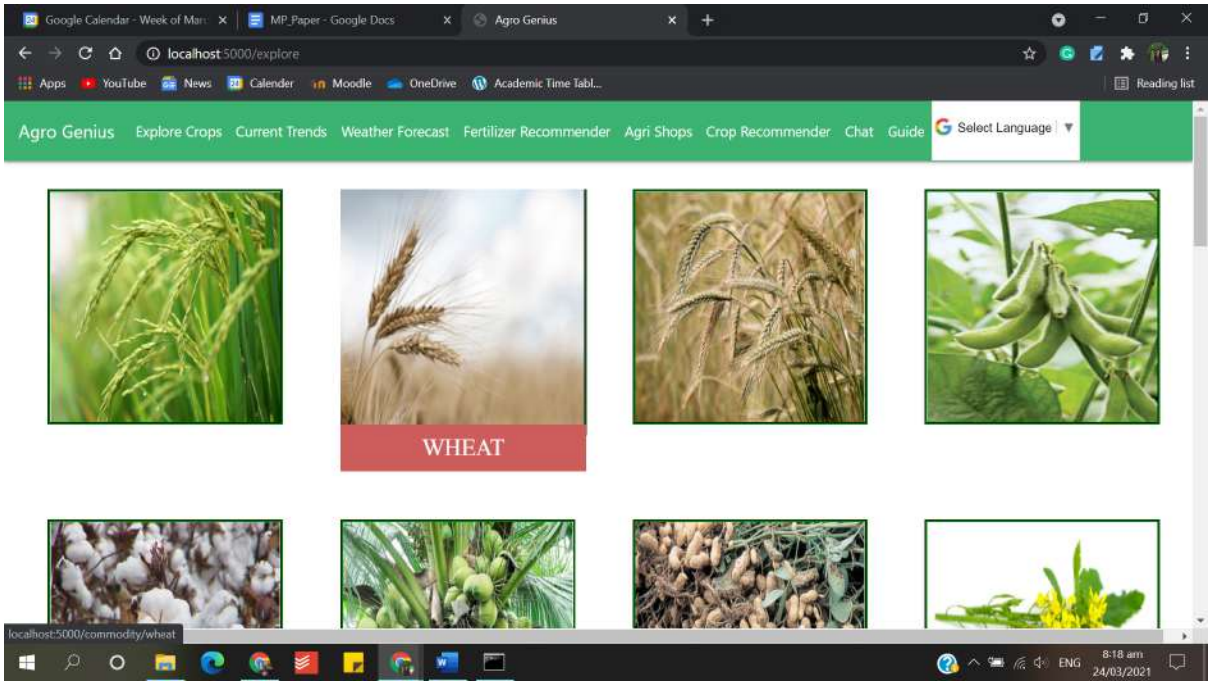
If we select the language in which we want to view the website. Here, Selected language is Hindi



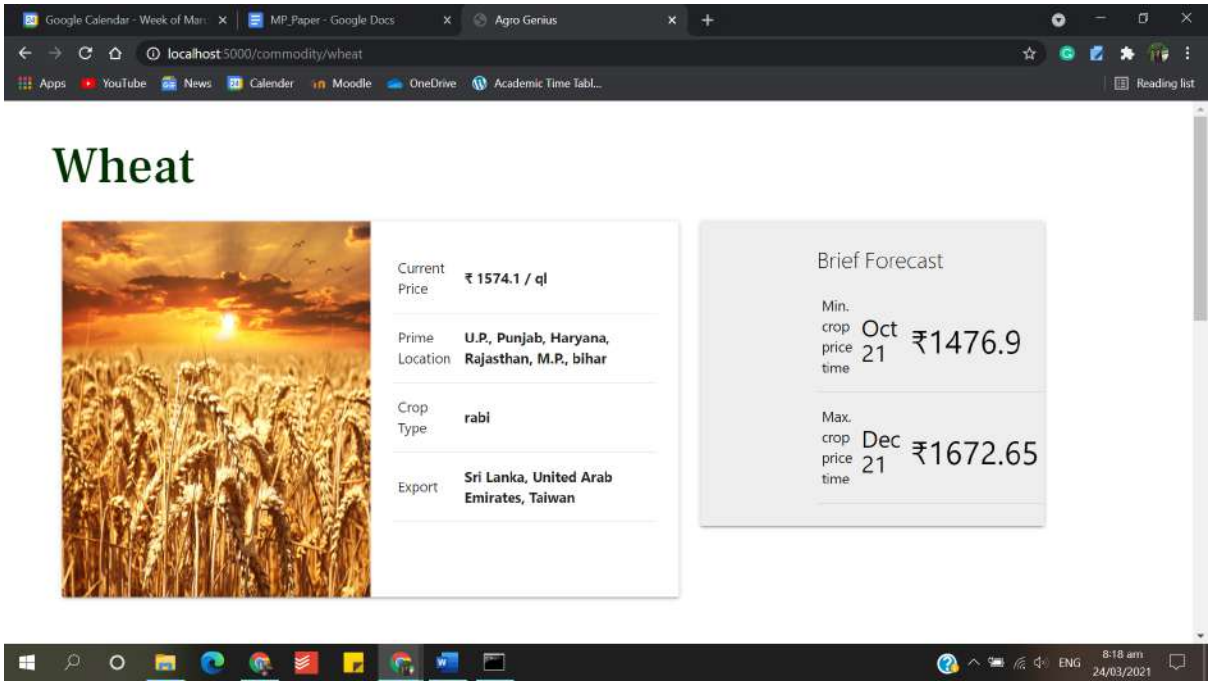
Explore crops page to see price prediction by clicking on crop

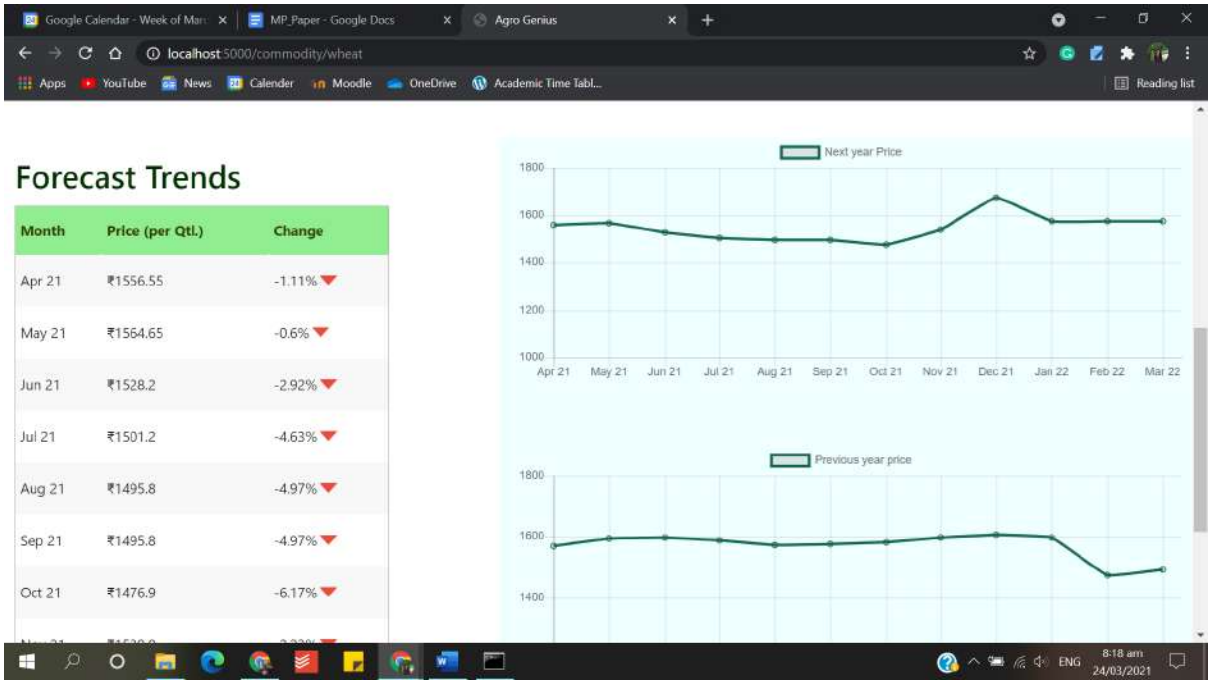


Selecting Wheat to check its price prediction



Wheat Commodity page




Google Calendar - Week of Mar
MP_Paper - Google Docs
Agro Genius
localhost:5000/commodity/wheat
Apps
YouTube
News
Calender
Moodle
OneDrive
Academic Time Tabl...
Reading list
Forecast Trends
Month
Price (per Qtl.)
Change
Apr 21 ₹1556.55 -1.11%
May 21 ₹1564.65 -0.6%
Jun 21 ₹1528.2 -2.92%
Jul 21 ₹1501.2 -4.63%
Aug 21 ₹1495.8 -4.97%
Sep 21 ₹1495.8 -4.97%
Oct 21 ₹1476.9 -6.17%
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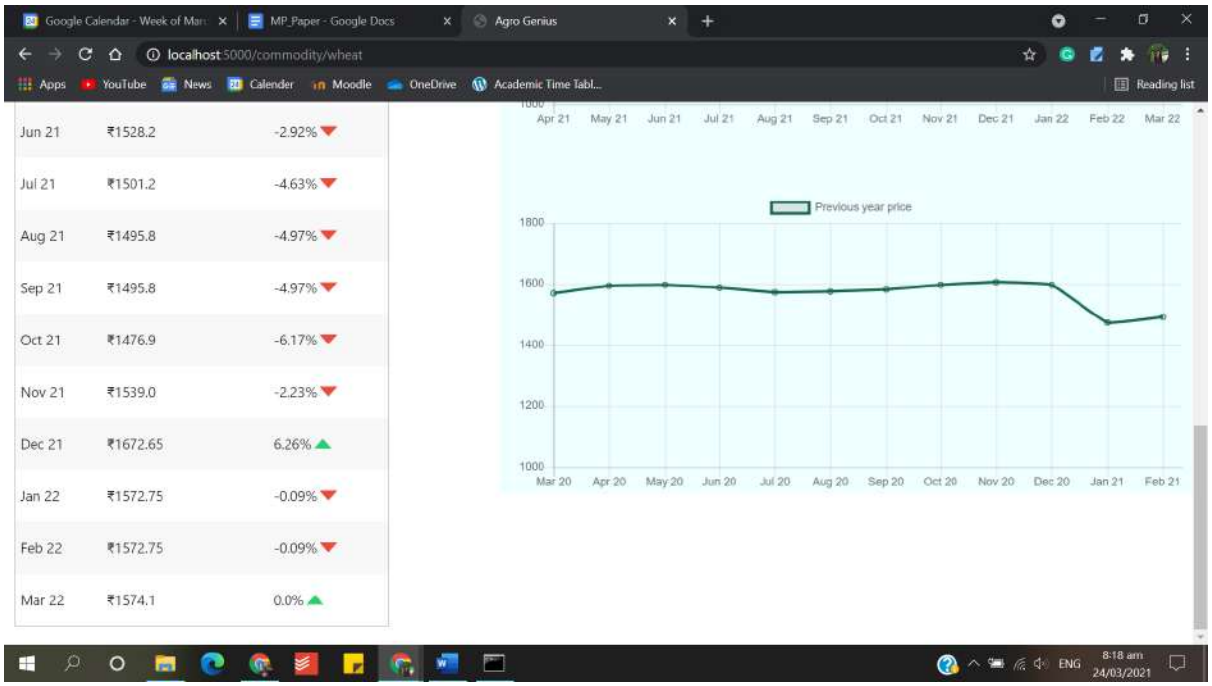
Google Calendar - Week of Mar
MP_Paper - Google Docs
Agro Genius
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Apps
YouTube
News
Calender
Moodle
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Academic Time Tabl...
Reading list
Jun 21 ₹1528.2 -2.92%
Jul 21 ₹1501.2 -4.63%
Aug 21 ₹1495.8 -4.97%
Sep 21 ₹1495.8 -4.97%
Oct 21 ₹1476.9 -6.17%
Nov 21 ₹1539.0 -2.23%
Dec 21 ₹1672.65 6.26%
Jan 22 ₹1572.75 -0.09%
Feb 22 ₹1572.75 -0.09%
Mar 22 ₹1574.1 0.0%
Apr 21 May 21 Jun 21 Jul 21 Aug 21 Sep 21 Oct 21 Nov 21 Dec 21 Jan 22 Feb 22 Mar 22
Previous year price
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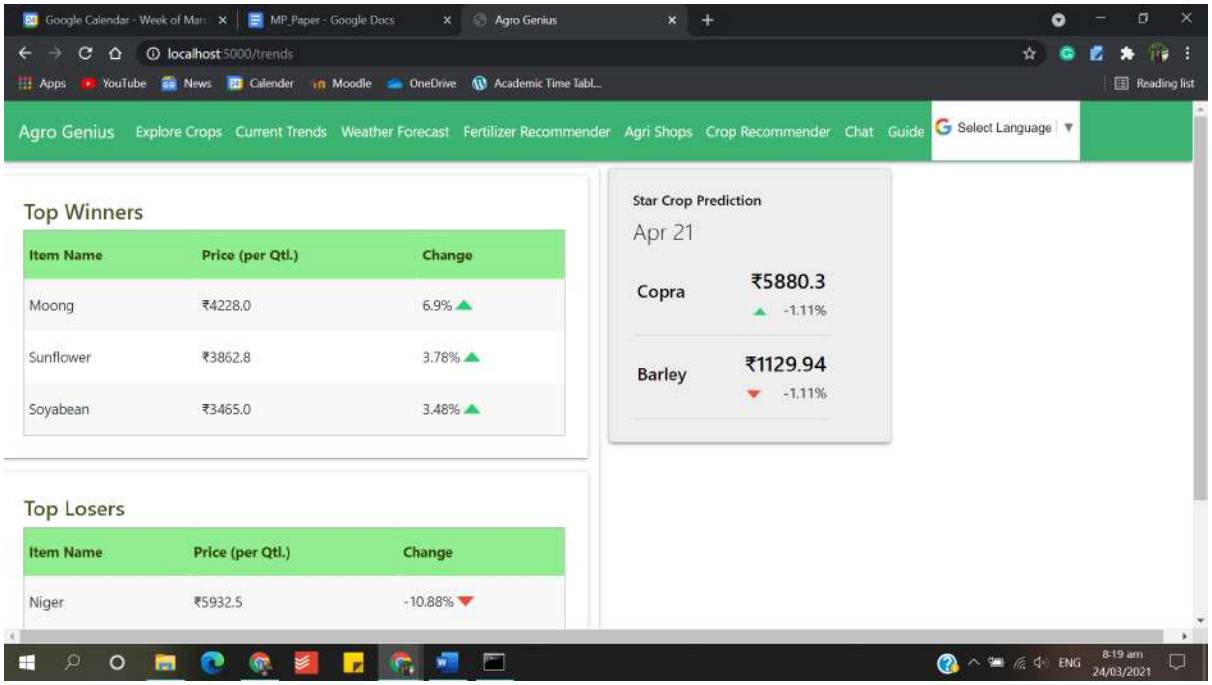
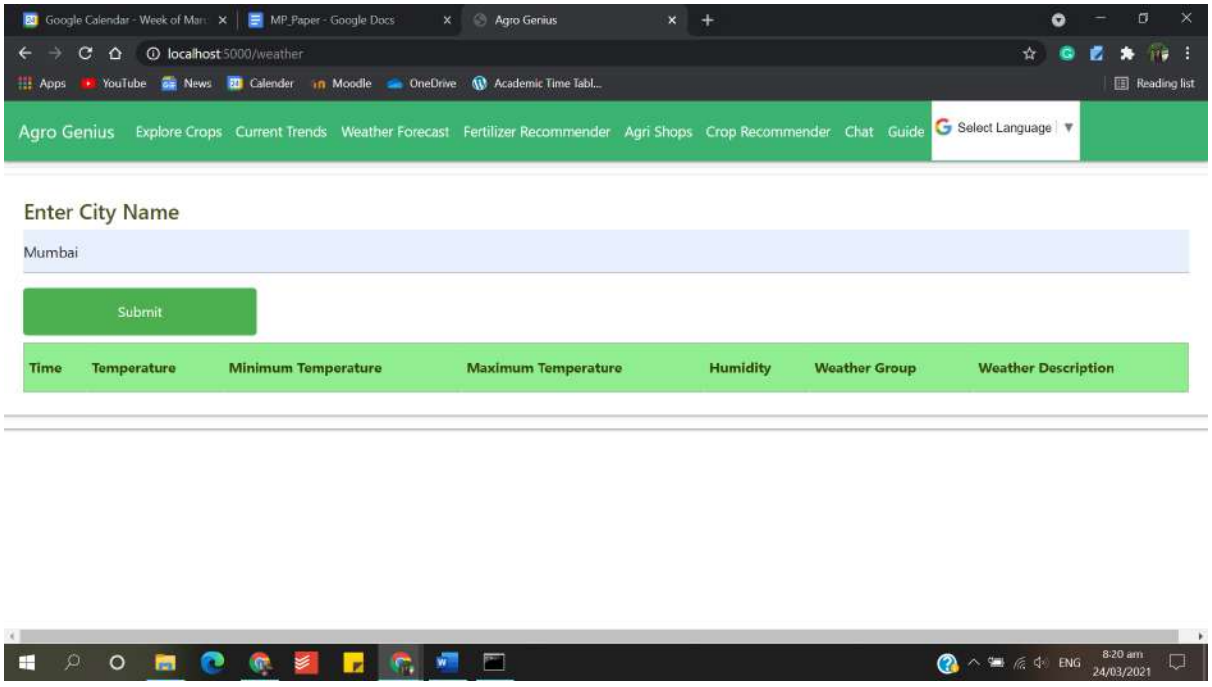
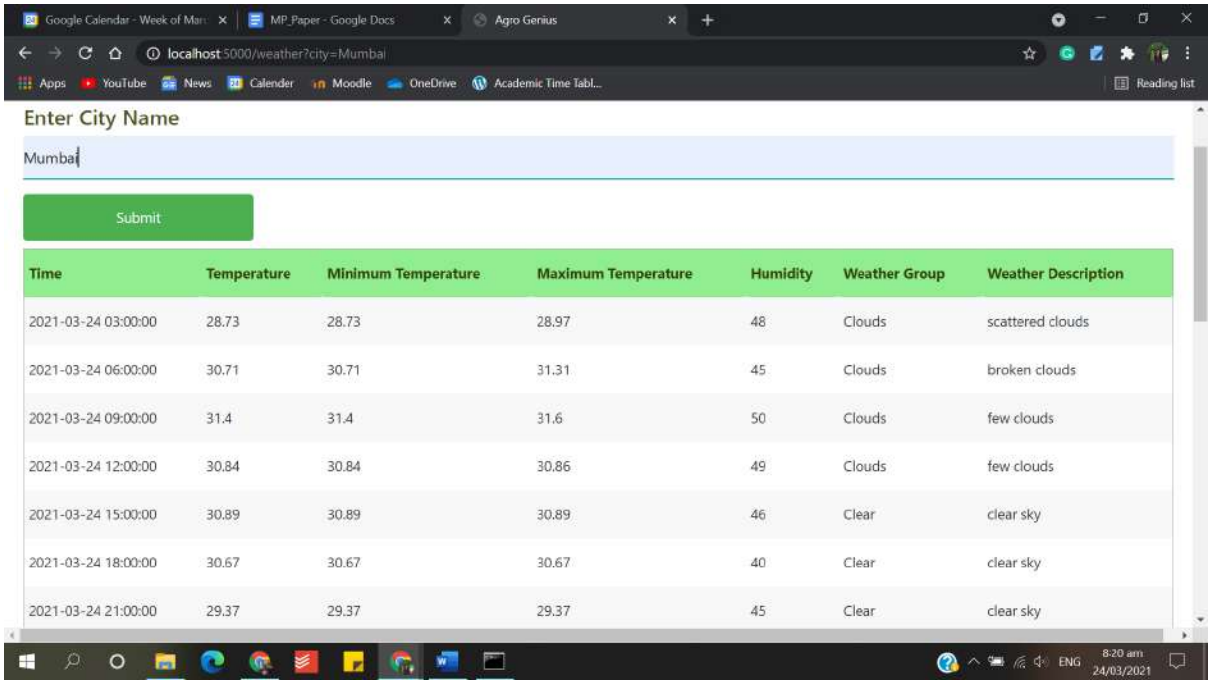
Current Trends

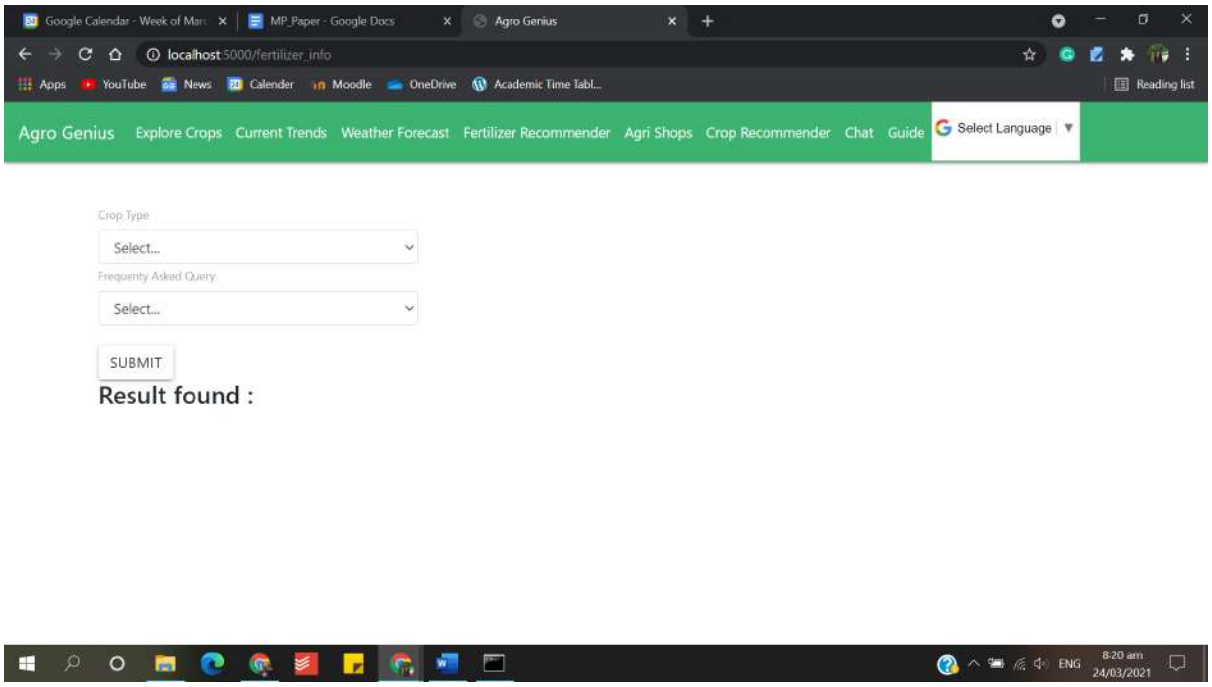


Weather Forecast page. Enter city name to gets its weather prediction for 5 days with 3 hours delay

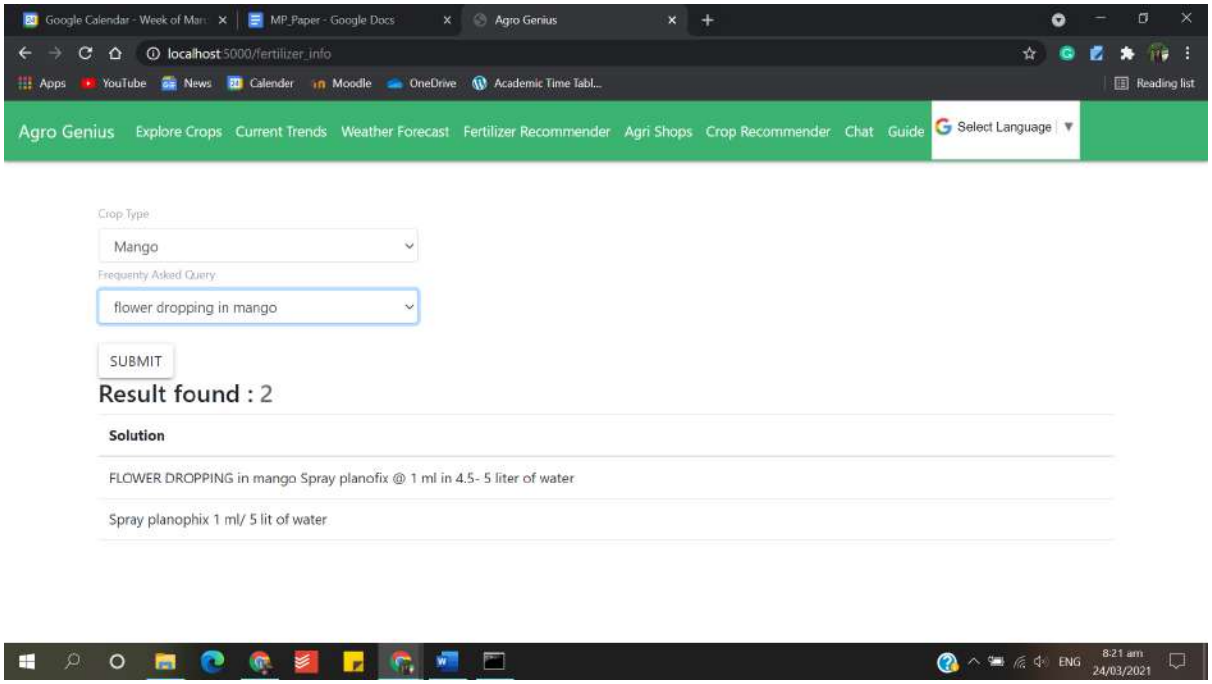




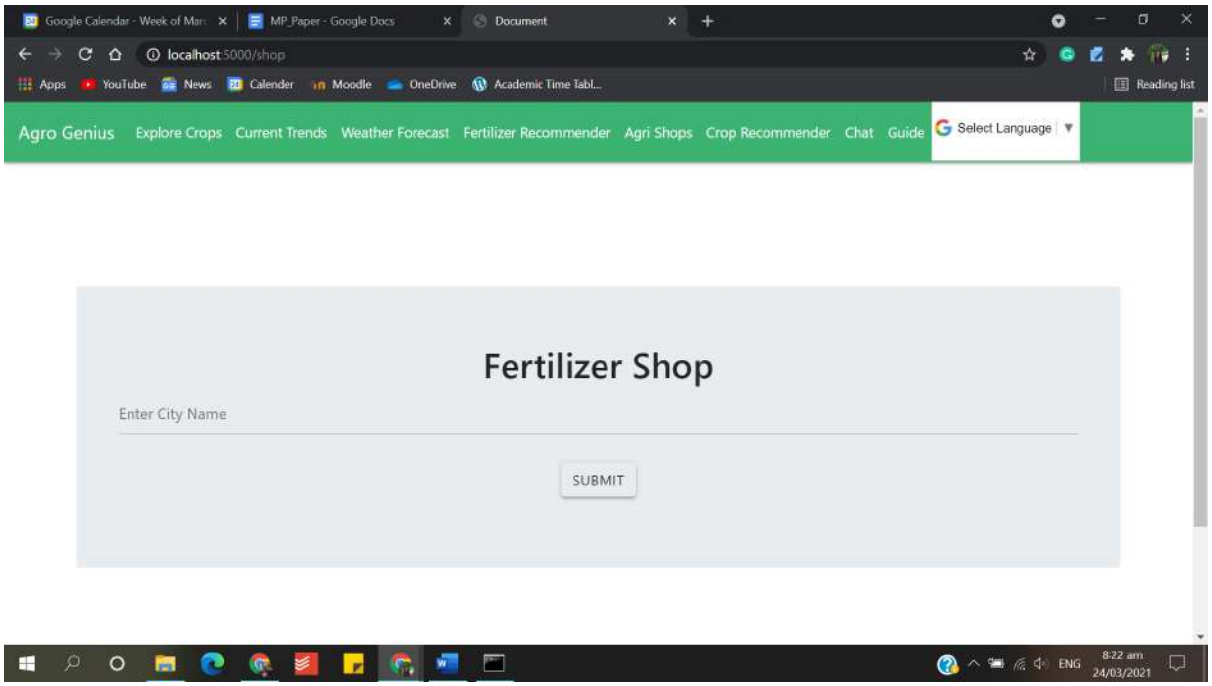
Fertilizer Recommender Page. Enter Crop Type and Query that the selected crop is suffering from.



After selecting the crop name and its query, We get the solution on that about what to do with the crop to make it disease free.

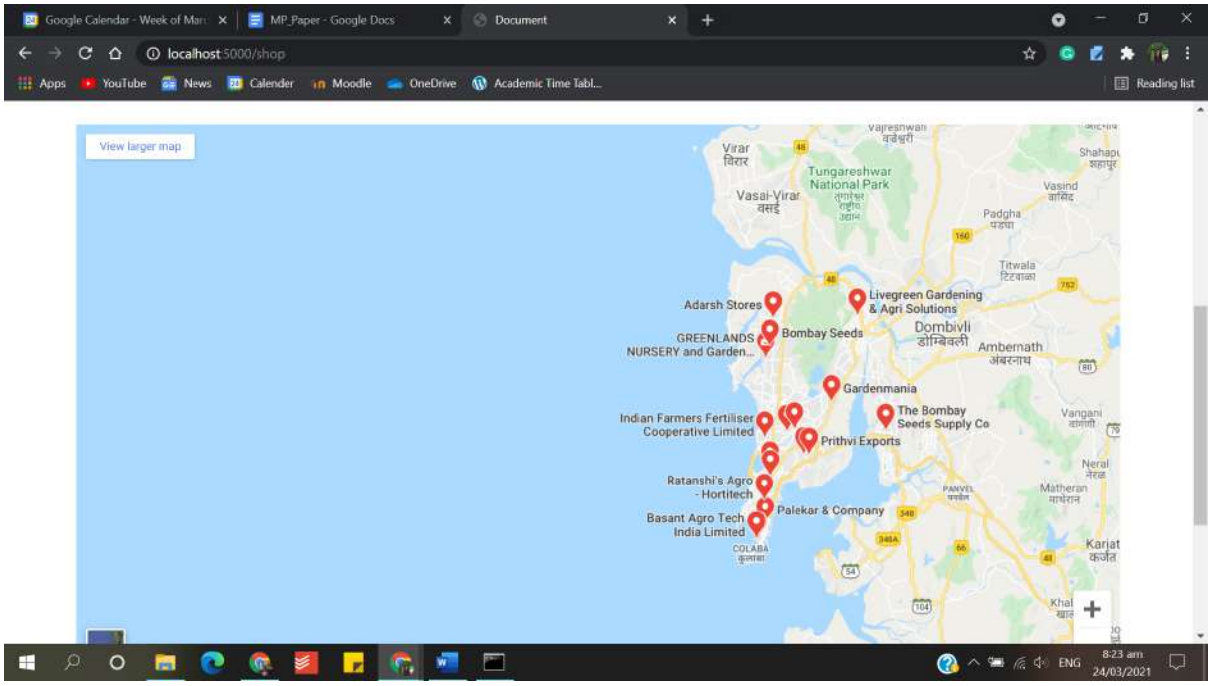


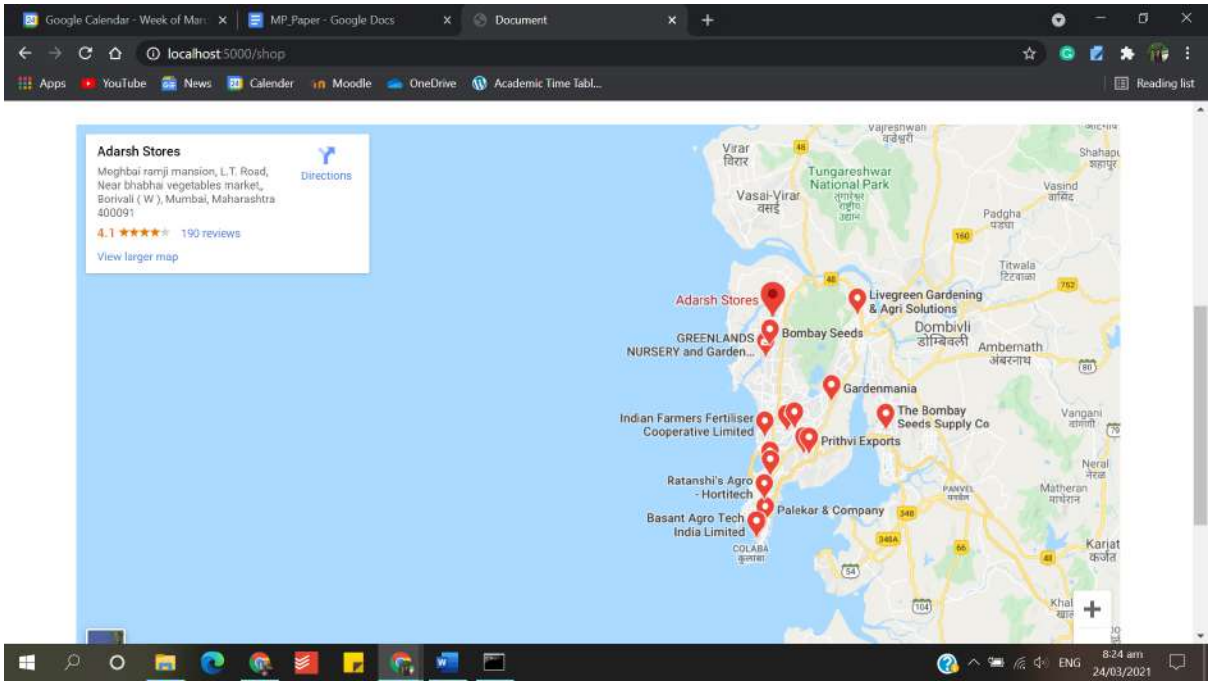
Fertilizer shop page to find out fertilizer and seeds shops near our city.



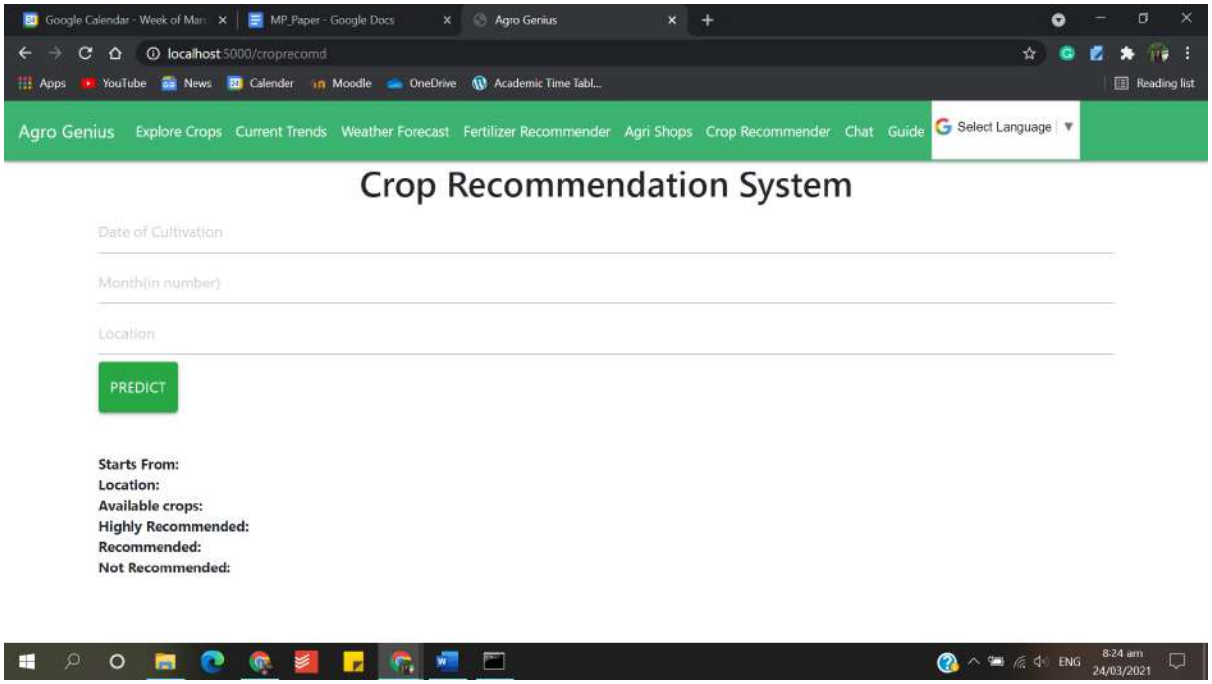
Entering city name (Mumbai), we get the map with marker as fertilizer and seeds shop

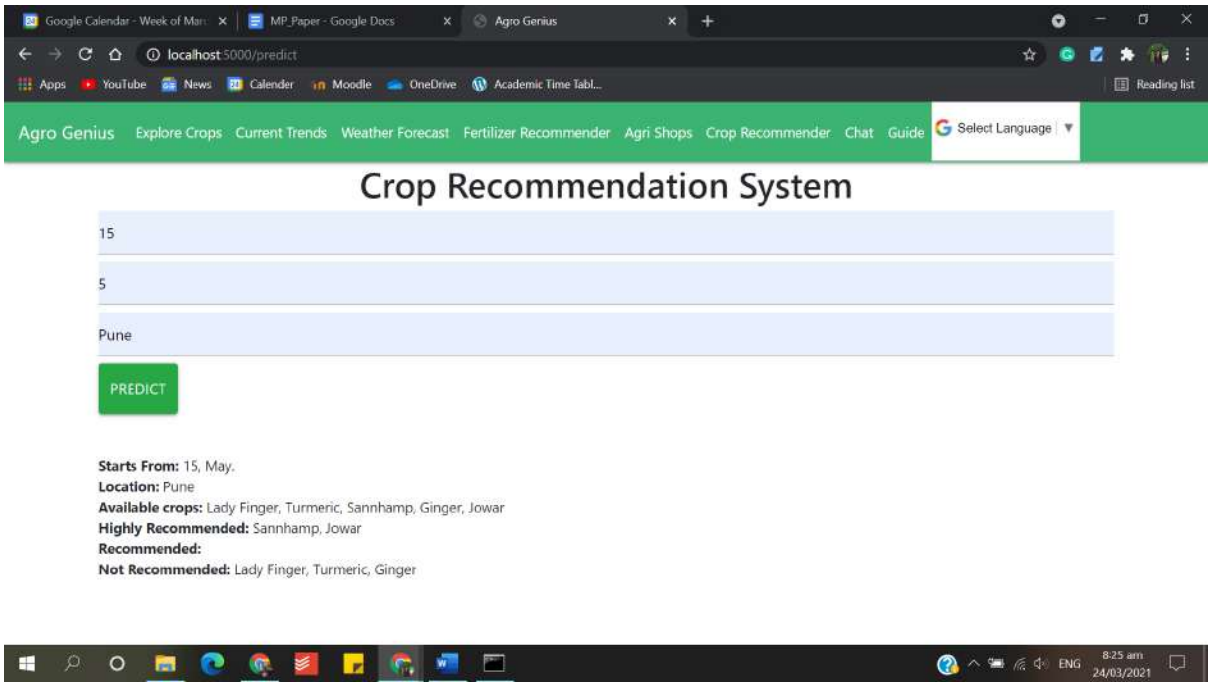
after clicking on the marker we get the address of the same.



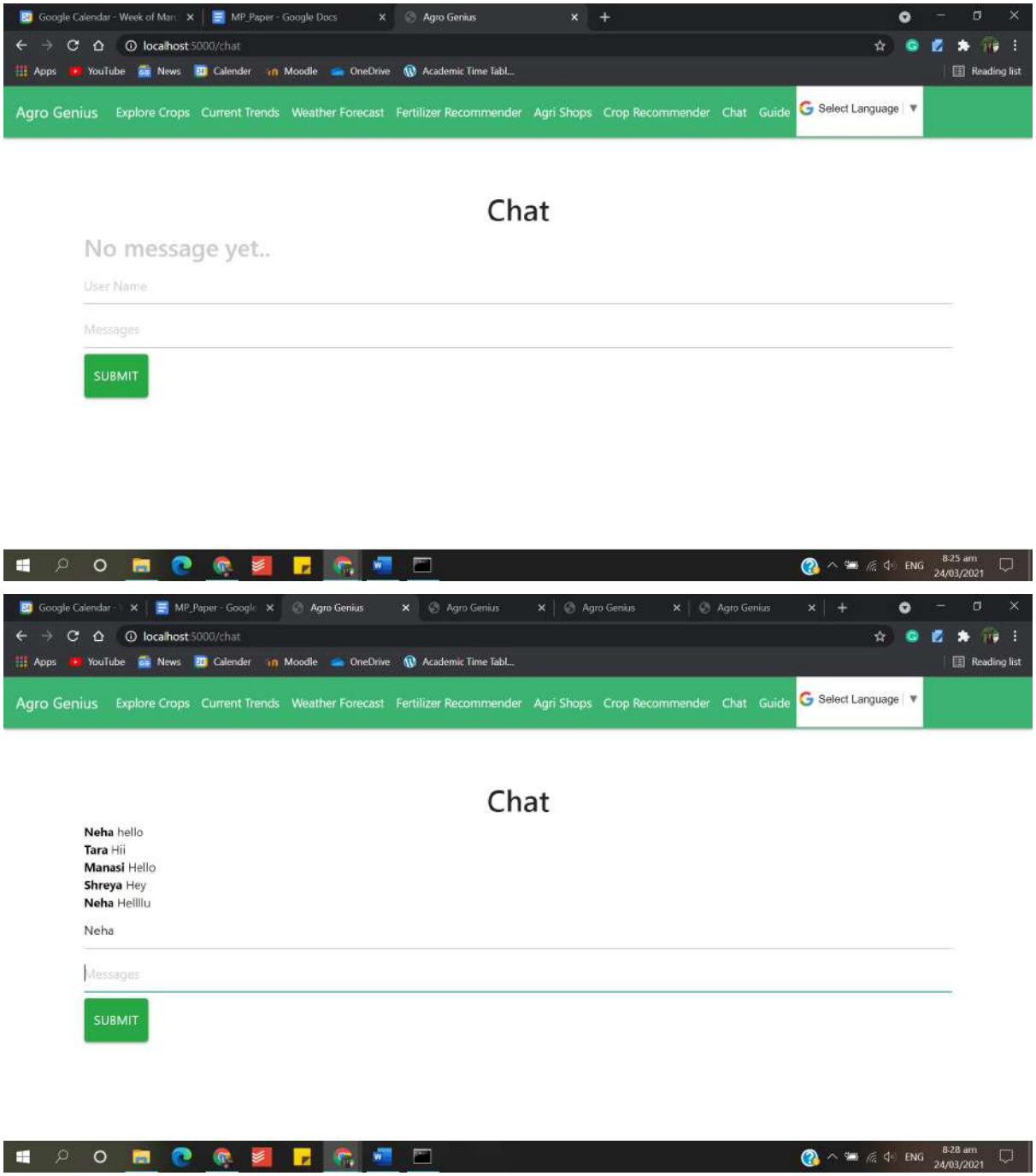


Crop Recommender Page. Enter Date of cultivation, Month, and Location and we get the crop recommendation of when to grow, what to grow and what not to.

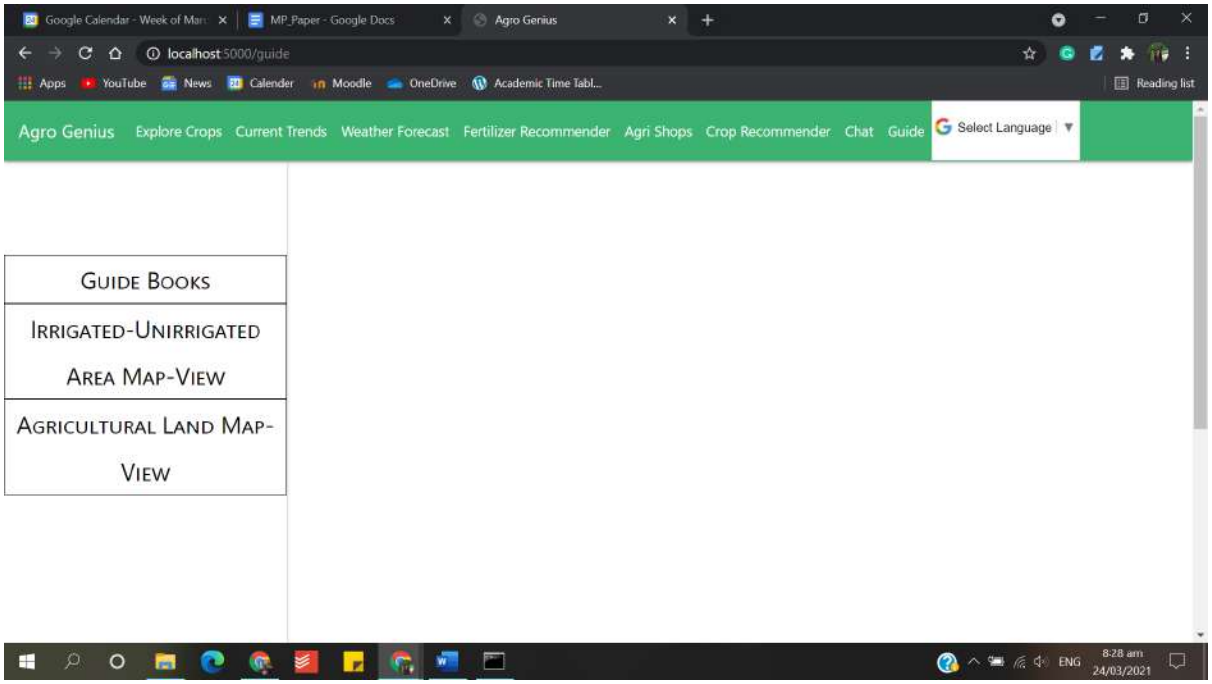




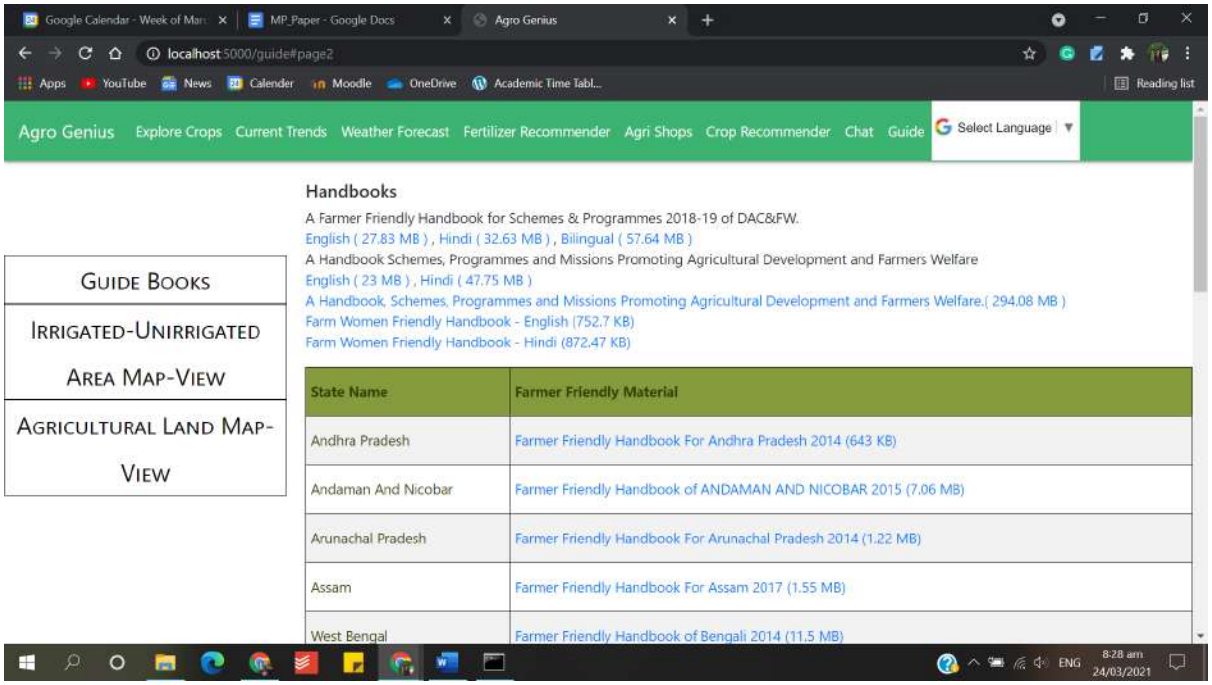
Chat Application page to contact with farmers.



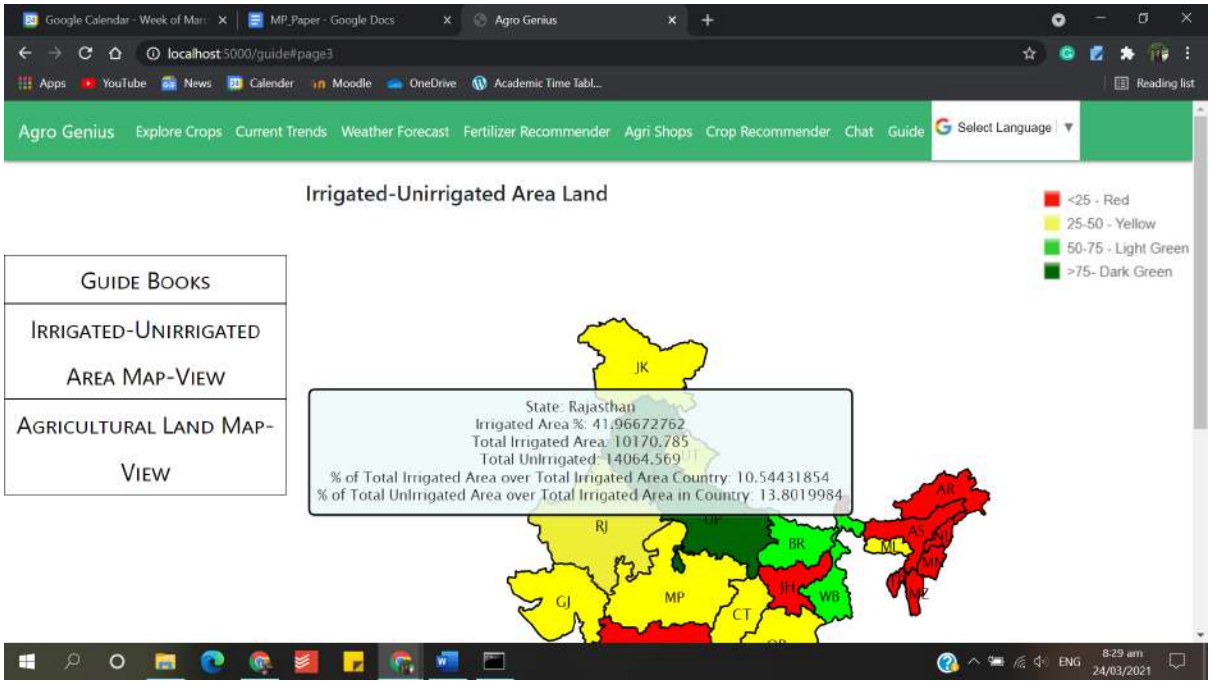
Guide Page for farmers who are new in this field



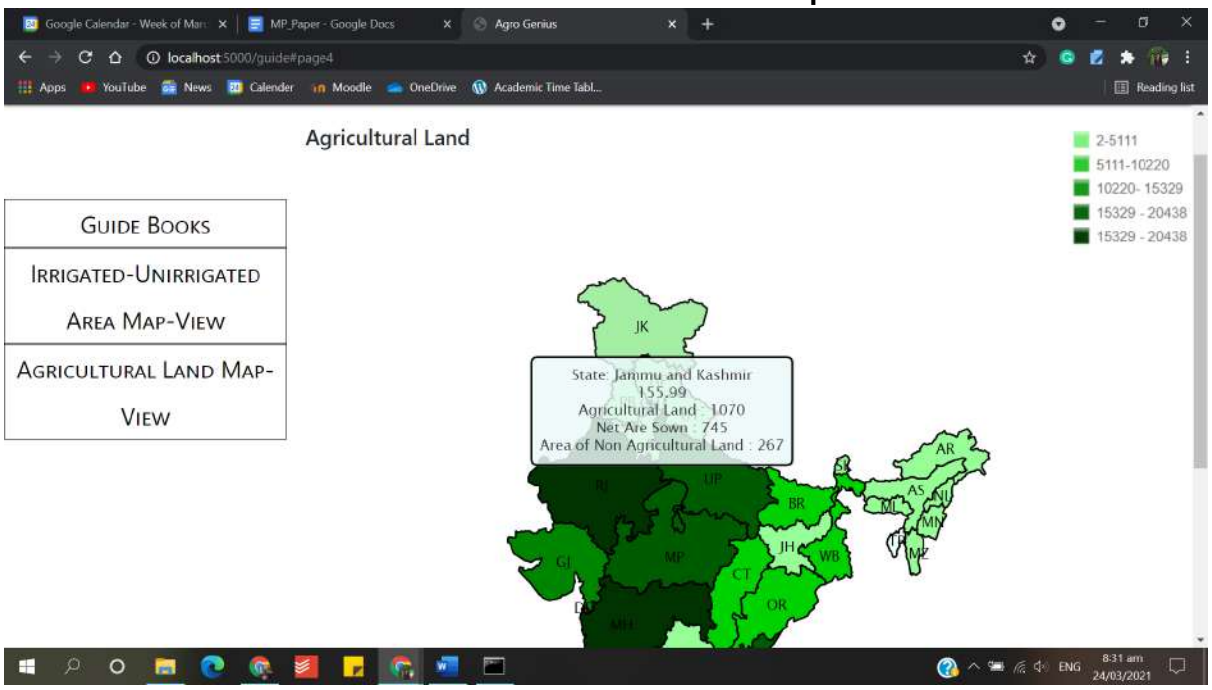
Handbooks with all information related to farming are present in this. Also, books are in state languages.



Irrigated-Unirrigated Area Land Map for information about irrigated and unirrigated land are present in the state. Hover on the state to look for information about the particular state



Agricultural Land Area Land Map for information about agriculture land are present in the state. Hover on the state to look for information about the particular state



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[5] Vohra Aman, Nitin Pandey, and S. K. Khatri. "Decision Making Support System for Prediction of Prices in Agricultural Commodity." 2019 Amity International Conference on Artificial Intelligence (AICAI). IEEE, 2019.
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7. Paper

7.1. Conference/journal details

2nd INCET 2021 is organized by
JAIN COLLEGE OF ENGINEERING & TECHNOLOGY, Belgaum Karnataka, INDIA. This conference is Technically Sponsored by IEEE Bangalore Section. Landmark – Goa ,India

7.2. Paper status – Submitted

7.3. Certificate

INCET2021 <incet2021@easychair.org> Mon, Apr 5, 10:50 PM (20 hours ago)

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Title : Farming Made Easy using Machine Learning

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Farming Made Easy using Machine Learning

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***Abstract* — Agriculture is the primary mainstay of the economy in our country. In recent years because of uncertain trends in climate and other fluctuations in the price trends, the price of the crop has varied to a larger level. Farmers remain oblivious of these uncertainties, which spoils the crops and causes massive loss. They are unaware of the crop type which would benefit them most. Due to their limited knowledge of different crop diseases and their specific remedies, crops get damaged. This system is handy, easy-to-use. It provides accurate results in predicting the price of the crop. This framework utilizes Machine Learning's Decision Tree Regression Algorithm to predict crop price. The attributes considered for prediction are rainfall, wholesale price index, month, and year. Consequently, the system gives an advance forecast to the farmers' which grows the speed of profit to them and consequently the country's economy. This system also incorporates other modules like weather forecast, crop recommendation, fertilizer recommendation, and shop, chat portal, and guide are also implemented.**

Keywords* — *agriculture, decision tree regression,price prediction, weather forecast, fertilizer, machine learning

I. Introduction

India being a rural nation, its economy transcendently relies upon agricultural yield development and unified agro-industry items. It is currently quickly advancing towards a specialized turn of events. India now is rapidly progressing towards technical development.Smart farming is changing the face of agriculture in India. Technology can provide a solution to most challenges farmers face. It can help them predict weather more accurately, decrease waste, boost output and increase their profit margins. In the status quo, the farmers and the consumers find it difficult in the real world to determine the accurate prices of crops without having prior knowledge of the fluctuating trend prices or weather conditions. Accordingly, innovation will end up being helpful to agriculture. The paper aims to predict crop prices in advance. This work is based on finding proper regional datasets that help us in achieving high accuracy and better performance. Our system, Agro-Genius, is using Machine Learning to build the Price Predicting Model.

In the past few years, a lot of fluctuation in the prices of the crop has been seen. This has increased the rate of crop damage produced each year. The main aim of this prediction system is to ensure that the farmers get a better idea about their yield and deal with the value risk.

Weather is also highly unpredictable these days. It also affects the crop production. The proposed system will also forecast the weather helping the farmer make correct decisions regarding field ploughing, field harvesting etc. Similarly, fertilizers play an important role. Fertilizers load the soil with the required nutrients that the crops eliminate from the soil. Crop yields and production will be fundamentally decreased if fertilizers are not used. That is the reason fertilizers are utilized to enhance the soil's supplement stocks with minerals that can be immediately assimilated and utilized by crops. Our system will provide fertilizer consumption based on different crops and provide a portal to buy the fertilizers and seeds from the user's location. They can even get the exact location along with the address of the fertilizer and seed shop. The provided fertilizers will get more profit to the farmers on the growing system suggested crop. It will also show the best suited crop based on cultivation date and month and location details, thereby maximizing the yield.

It will provide multilingual and region specific guide books for the farmers. Any farmer who is new to this field and who wishes to gain information from his ancestors but having the same methods documented will be highly beneficial. We have also provided maps for the farmers to gain knowledge. Our system will provide two different types of maps for the farmer to gain the knowledge about how the land and where they should start their farming. Irrigation maps show the irrigated-non irrigated area over the country. Agriculture land view map will provide an overview of agricultural land present in various states of India and help farmers to analyze the non Agricultural land which can further be improved. Maps make the farmers easy to understand they have to just hover on the state they are thinking of starting their farming and they will get the information about that state and they can decide whether they should change the place or should start farming. If the farmers are new in this field it is the best thing for them as the most important thing in farming is to firstly choose the land and place of farming.

Moving in the same direction, our system will incorporate a chat application which helps in information sharing. Often farmers have certain queries which cannot be

solved due to their limited knowledge, hence we are building a platform where information can be exchanged. Language can pose as a barrier to the users. Since the majority of non-English speaking farm workers in India are native Hindi-speakers, we anticipate that once these resources are developed they might be translated to other languages as well. Hence, to make the website user friendly, we have provided language translation.

Farmers should know about their location, date of cultivation of their crop. Our system is a web application, which is developed based on machine learning concepts. The proposed system applies machine learning and prediction algorithms like Naive Bayers, Decision Trees and K-Nearest Neighbour to identify the most accurate model and then process it. This in turn will help predict the price of the crop.

II. LITERATURE SURVEY

The following papers focussed on predicting crop price using Machine Learning and providing results. In April 2019, the exploration targets foreseeing both the cost and benefit of the given harvest before planting.The preparing datasets so acquired give enough bits of knowledge to foresee the suitable cost and request in the business sectors[1]. The authors have predicted the most profitable crops and its expected price during harvesting time according to the location, by predicting different historical raw datasets using different machine learning algorithms. The work shown by Nishiba [2] is the expected utilization of data mining procedures in foreseeing the harvest yield dependent on the input parameters average rainfall and area of the field. The easy-to-use website page created for anticipating crop yield can be utilized by any client by giving the normal precipitation and region of that place. Different Data Mining techniques are applied to different datasets. This paper can also include certain modules [11] which can help farmers to make certain decisions based on the harvested area or current trends in the market. The system can be extended by visualizing the crop details in a map with details, which will help farmers to view the nearby district cultivation details. Proposed system can be enhanced by providing a graphical visualization of predicted prices for better understanding.

This system is proposed to provide help to the farmers for expecting the best amount for their crops and for predicting the best price for the crops. This also helps the farmers to check previous prices of different commodities. The system can predict crops using [9] Random forest, Polynomial Regression and Decision Tree algorithms. The best crop and its required fertilizers make the farmer more confident about the crop and its yield and also our system will do marketing work [4] by estimating total value of the crop based on current market price. The idea of the system can be extended by adding some extra features to the system like providing a nearby shop location portal for purchasing seeds and fertilizers.

These papers aim at predicting the price and forecast through web application and it runs on efficient machine learning algorithms like using an Autoregressive Integrated Moving Average (ARIMA) model,Traditional ARIMA [6], Support Vector Regression Algorithm[8], and technologies having a general easy to use interface to the clients. The training datasets [7] acquired give sufficient bits of knowledge to foreseeing the appropriate price [10] and request in the markets. The results are displayed as web applications in order that poor farmers can access easily. Models can be improved by integrating this with other departments like horticulture, sericulture, and others towards the agricultural development of our country. Different agriculture departments have various problems in the current time. Incorporating them will not only increase the scope but also help the farmers new to this part of the spectrum. Their work may be expanded by building a framework for suggesting agriculture produce and dispersion for farmers. Utilizing this framework, We ought to get the same accuracy indeed when an information autonomous framework is utilized. Further, can be enhanced by making an android application for the same.

III. PROPOSED SYSTEM

A. Description

We have used Python for basic programming in all modules. Flask is used for hosting. Socket Programming is used for a chat application. Chart.js is used for visualizing the maps. JavaScript is used for validation purposes.

For Weather Forecast [12] and fertilizer shop location, we have used APIs. Using the self-made dataset and concept of linear regression in machine learning we have implemented a Crop recommendation model so that a farmer can learn about the best suited crop for a particular region. In Fertilizer Recommendation we have used a dataset for predicting which fertilizer should be used for the disease present on crops. Socket programming is used for farmers interaction using provided chat application [3]. Google Api is used for providing a multilingual website for ease to read.

Refer Figure no. 1 to navigate through the web application.

B. Comparison of Algorithm

Parameter	KNN	Naive Bayes	Decision Tree
Deterministic/ Non-deterministic	Non-deterministic	Non-deterministic	Deterministic
Effectiveness on	Small data	Huge Data	Large Data
Speed	Slower for large data	Faster than KNN	Faster
Dataset	It can't deal with noisy data	It can deal with noisy data	It can deal with noisy data
Accuracy	Provides high accuracy	For acquiring great outcomes, it requires an enormous number of records	High accuracy

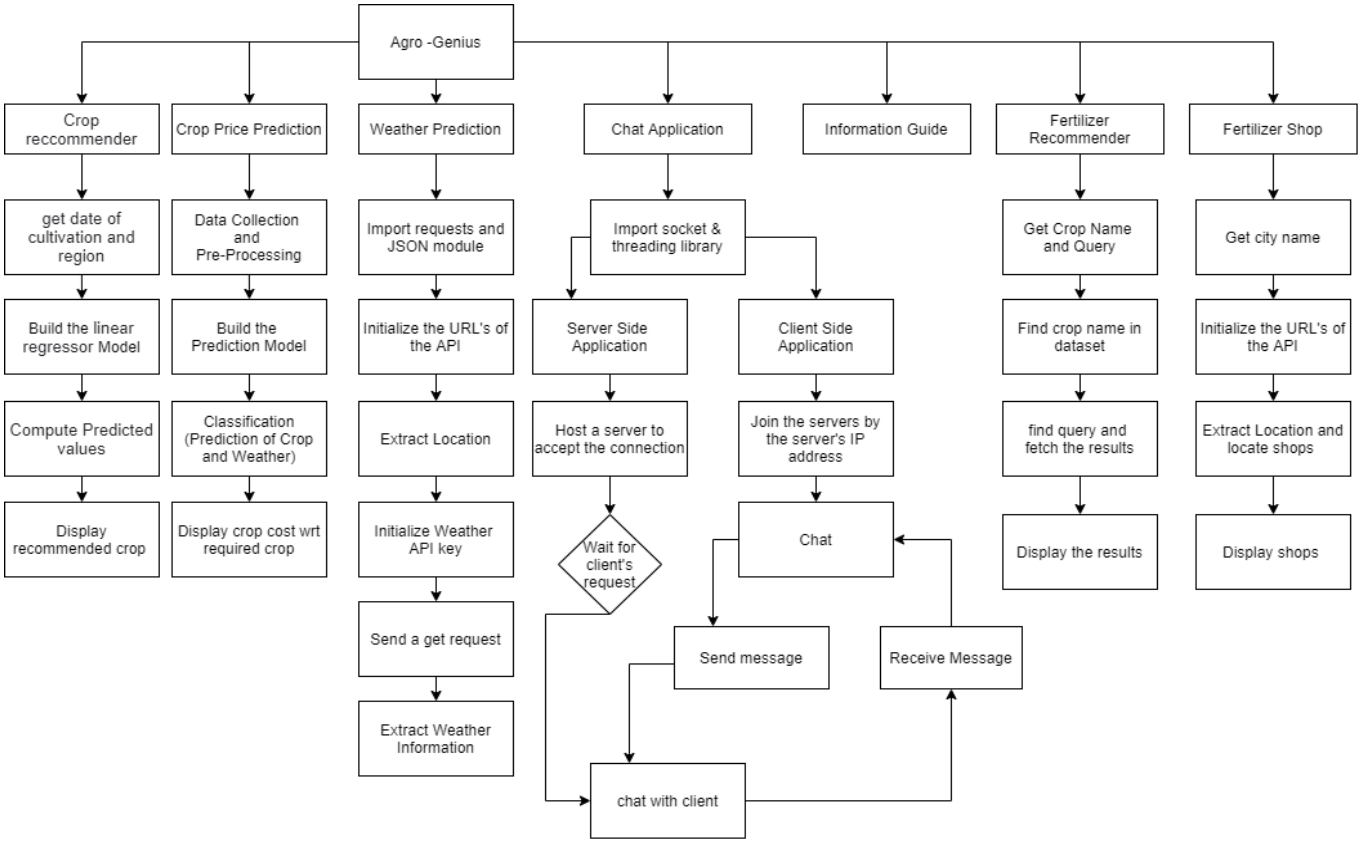


Figure1: Flow Diagram of Agro Genius (All Modules)

So, we will be using the Decision Tree Regression Algorithm for crop price prediction which gives approximately 95-97% accuracy.

C. Decision Tree Regression Algorithm

The decision tree regression machine-learning technique watches features of an item and trains a model in the structure of a tree to anticipate data later on to make significant nonstop output. Continuous output means that the output is not discrete, a known set of numbers or values.

The input to the algorithm is: -

1. Input parameter
2. Training dataset

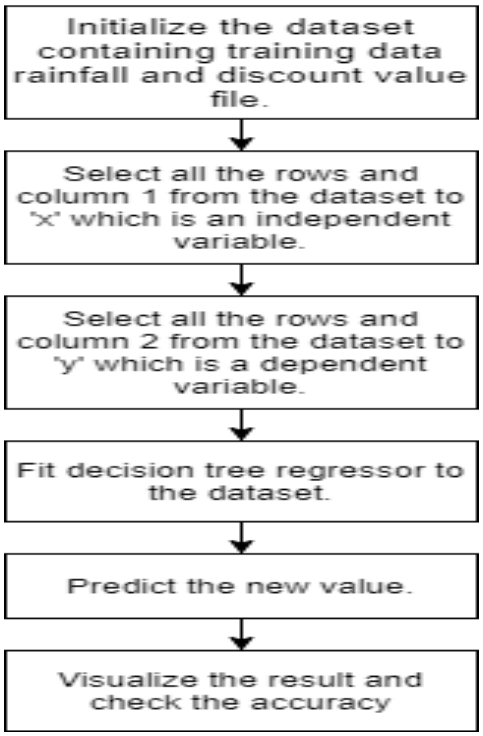
Formulas used for prediction

$$SSE = \sum_{i \in s1} (y_i - y1) + \sum_{i \in s2} (y_i - y2)$$

Where y1and y2 are the values of the dependent variable in group s1and s2 that is wholesale price index parameter in the dataset

For bunch s1 and s2 that is rainfall, it will recursively part the indicator esteems inside gatherings. The process stops when the sample size of the split group falls below a certain threshold.

Steps to Implement the Algorithm:



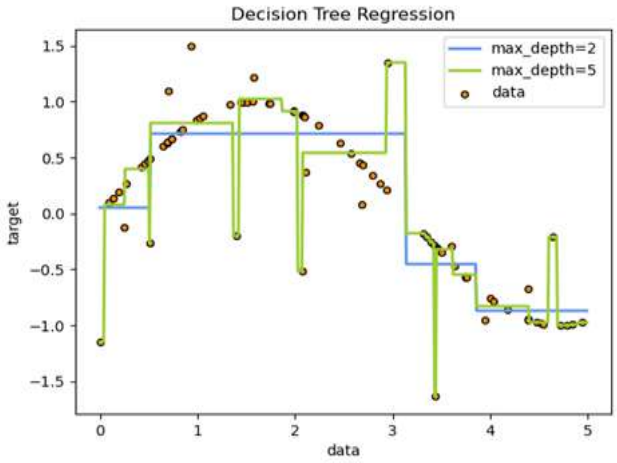


Figure 2: Decision Tree Regression

The default values for the parameter controlling the size of the tree is max_depth to decrease memory utilization and complexity.

The performance of decision tree regression is estimated by three metrics - Mean Absolute Error, Mean Square Error and R^2 score.

IV. IMPLEMENTATION

The dataset which is used is obtained from the official site of the government of India.

We trained the model on KNN, Naive Bayers, Decision Tree Regression algorithms and found that the Decision Tree Regression algorithm reduced the overfitting problem. It also improved accuracy significantly.

We performed testing and training on our dataset. The model was trained and thus the results obtained were noted.

Then, compared the expected result with the initial data set. Later, we used the test samples to estimate the accuracy of the model. We predicted the accuracy of the model with different algorithms. Out of the 3 algorithms used, we concluded that the Decision Tree Regression gave the best results and hence used the same to train our model.

In Weather Forecast, using the openweathermap API, we are forecasting the weather by taking the city name as an input from the user.

For Crop Recommendation, the user has to give input parameters such as Date of Cultivation and Location. Using the self-made dataset of Maharashtra state and applying linear regression, crop recommendation model which will display most suitable and least suitable crops.

For Fertilizer Recommendation, we are taking crop name and disease present on the crop as an input and by using the dataset we are displaying the appropriate recommended fertilizer.

To see nearby Agri-Shop, we initialized google API and using location and recommended fertilizer, location of nearby shops are displayed.

For Chat, we initialized socket and established a connection between client and server.

V. RESULTS

Utilizing this framework, We ought to get the same accuracy indeed when an information autonomous framework is utilized.

For testing purposes, we have calculated the mean absolute error, Coefficient of determination R^2 and Variance score of both training and testing dataset. Along with that we have calculated accuracy for the test dataset.

For Paddy:
R^2 of the Test Set: ~0.9999
R^2 of the Train Set: 1.0
Mean absolute error test set: 1.64
Test Variance score: 0.98
Mean absolute error Training Set: 4.72
Training Variance score: 0.70
Test Set Accuracy ~ 0.9773

In this graph, the Real values are plotted with “Red” colour and the Predicted values are plotted with “Green” colour.

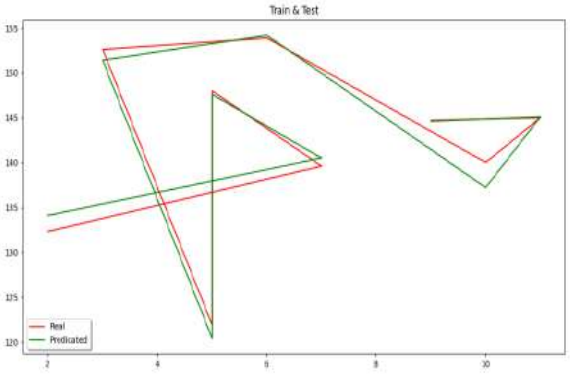


Figure 3: Real Values versus Predicted Values

In Figure 3 output shows a little deviation from the real values. We have achieved an accuracy of ~97% after training the model.

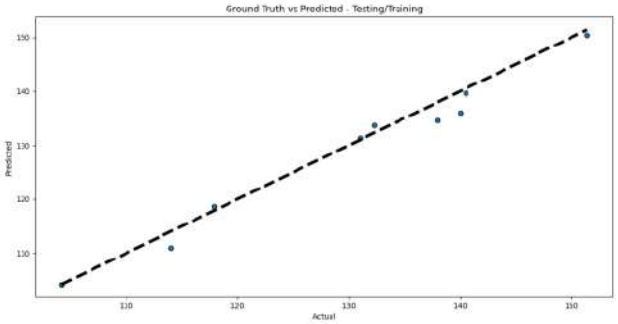


Figure 4 : Prediction Errors

Figure 4 visualizes the prediction errors.

We get the weather forecast of 5 days with 3 hours of interval showing temperature, maximum temperature, minimum temperature, humidity, weather group and weather description

Farmers get the recommendation for the best suited crop and least suited crop for the entered location.

The farmer gets the recommended fertilizer on the disease name provided by the farmer on the crop.

Once the farmer sees the fertilizer, he can easily shop the fertilizer and some required seeds using the shopping portal created.

Farmers can communicate with each other easily by selecting the chat option. Group chat is also made available.

To make the website multilingual, we have used google translation to translate the website in 20+ languages.

VI. CONCLUSION

This project is undertaken using machine learning and evaluates the performance by using KNN, Naive Bayes, and Decision Tree algorithms. In our proposed model among all the three algorithm Decision Tree gives the better yield prediction as compared to other algorithms

As most extreme sorts of harvests will be secured under this system, farmers may become more acquainted with the yield which may never have been developed. The work exhibited the expected utilization of machine learning methods in foreseeing the harvest cost dependent on the given attributes. The created web application is easy to understand and the testing accuracy is over 90%.

VII. FUTURE SCOPE

This system can be enhanced by building a model with an increase in the number of crops. This paper aims at recommending crops in maharashtra. We can extend our research by including region wise dataset. Organic fruits and vegetables can also be taken into consideration to increase the scope of the project.

Lastly, include category-wise AgriVideos. Farmers will be able to choose the category in which section they want to browse and watch videos related to that category.

VIII. REFERENCES

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