FARMING MADE EASY

USING MACHINE

LEARNING

Minor Project Report

by

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Minor Project Approval Certificate

This is to certify that the Minor 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

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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.
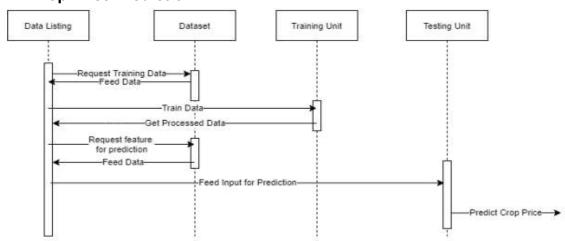
Priority: 6

- 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.
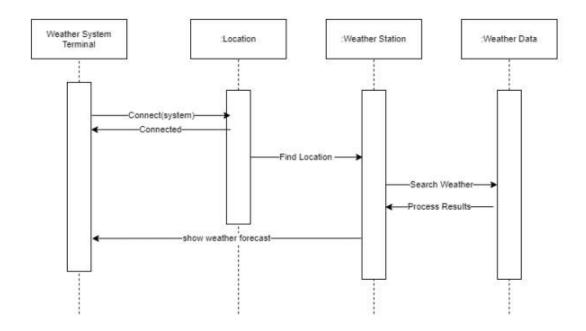
Acceptance Criteria: At the time of usage, the user will know the list of crops provided by the system along with their details.
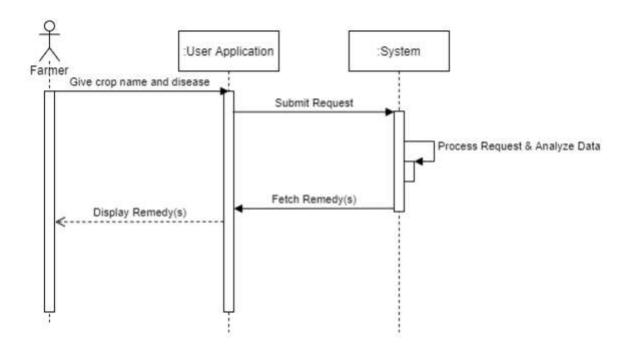
Priority: 7
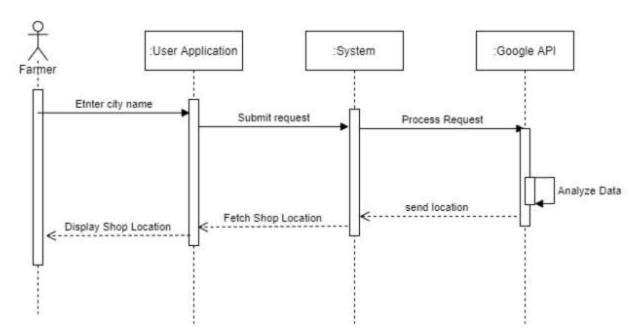
3.2. Sequence Diagrams
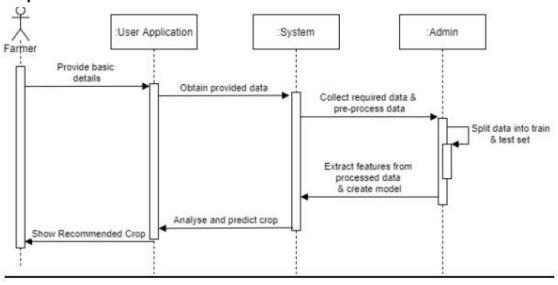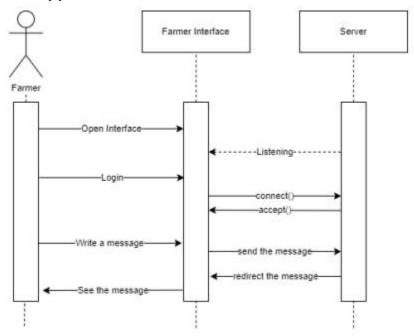### Crop Price Prediction

Weather Forecast

Fertilizer Recommender
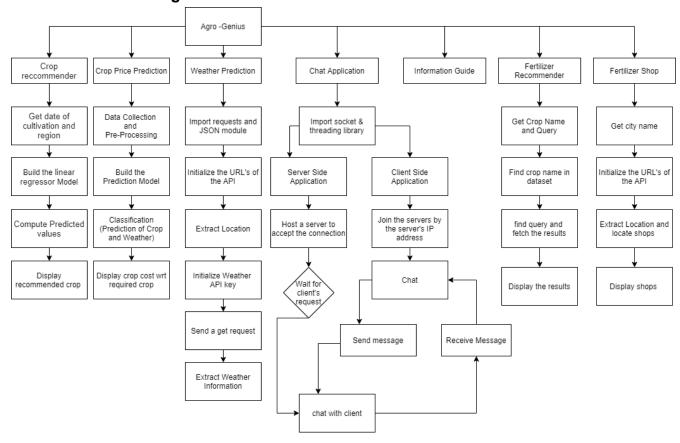

Fertilizer Shopping Portal

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

```python
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:
```

```python
            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

```python
@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
```

```python
        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

```python
@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

```python
@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."
```

```python
    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

```python
@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

```python
@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
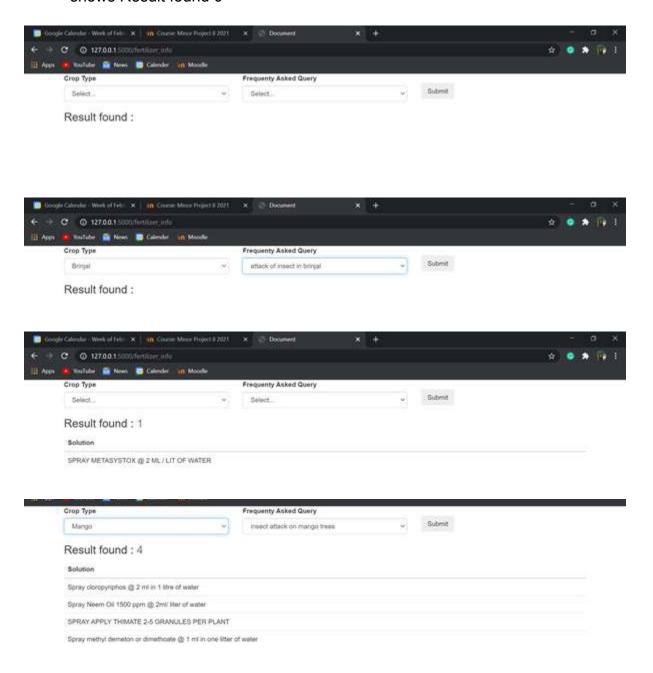
```
@app.route('/guide')
def guide():
    return render_template('guide.html')
```
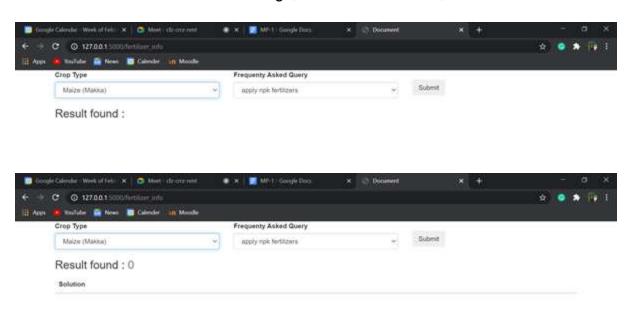
5.2. Test cases
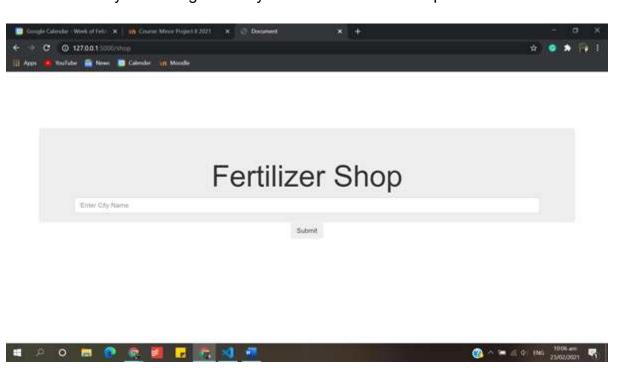
1. In Fertilizer Information Page, if result if found it shows the result, otherwise it shows Result found 0
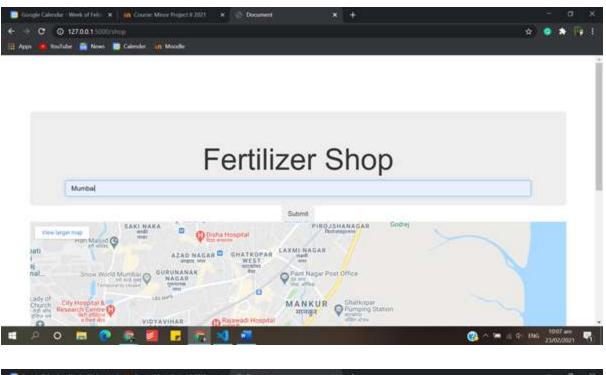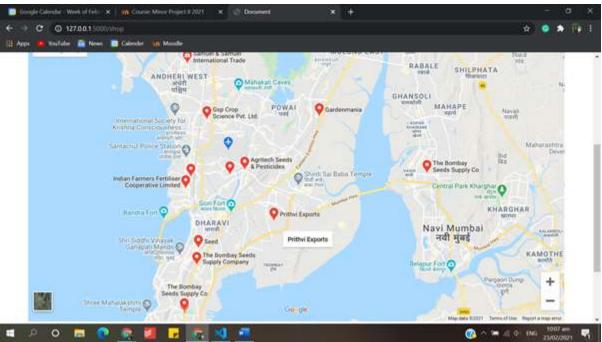
2. In the Fertilizer Information Page, if result is not found, it shows Result found 0.
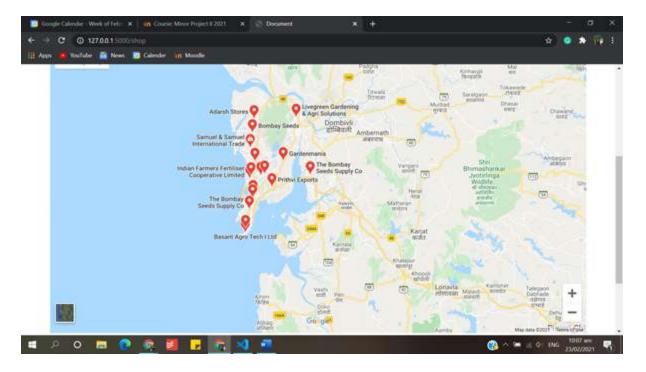
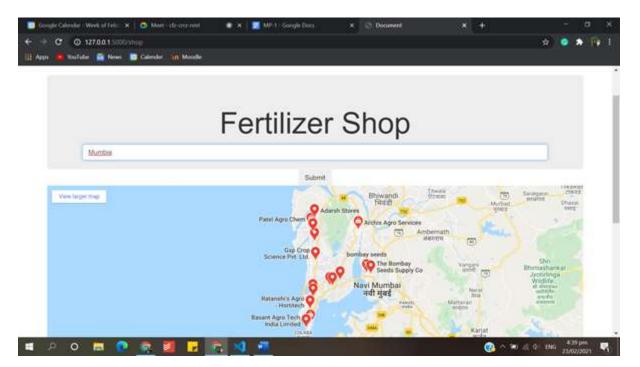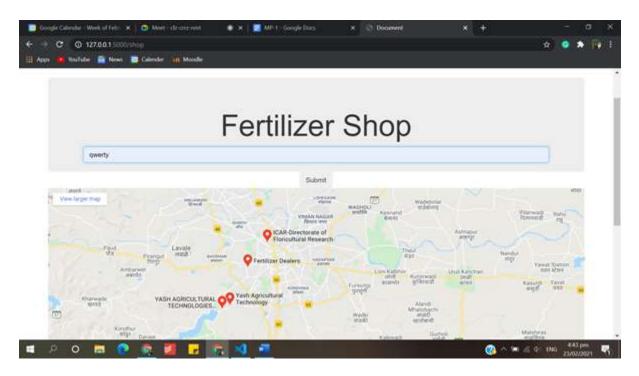3. Enter City name to get nearby fertilizers and seed shop

4. If the entered city name is wrong, it will search the city whose name is approximately similar to the entered city name.
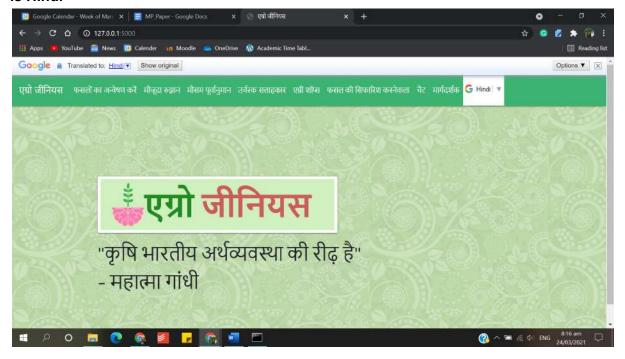
   Here I entered Mumbai which is similar to Mumbai so the shops in Mumbai are displayed.

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.
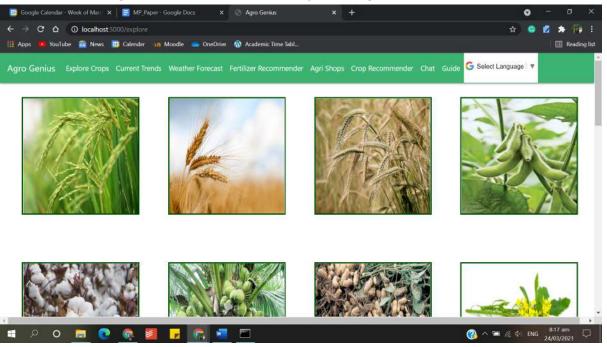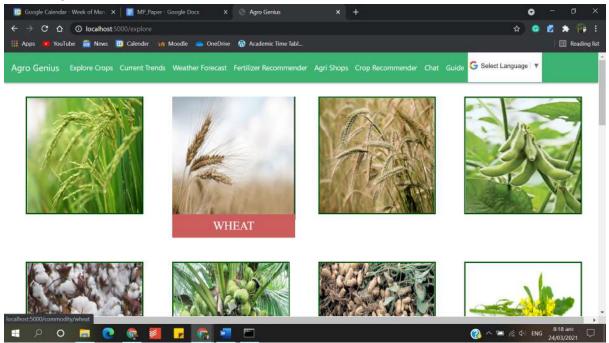

5.3. Continuous Integration Testing
Home Page:

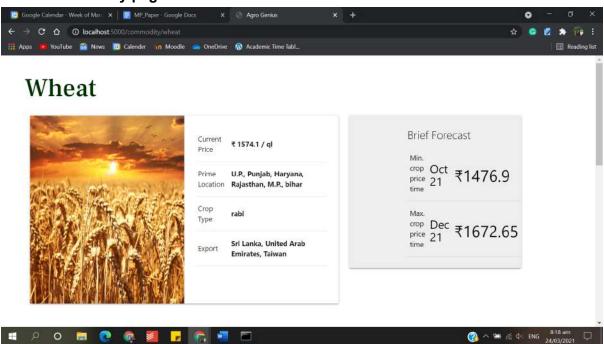**If we select the language in which we want to view the website. Here, Selected language is Hindi**

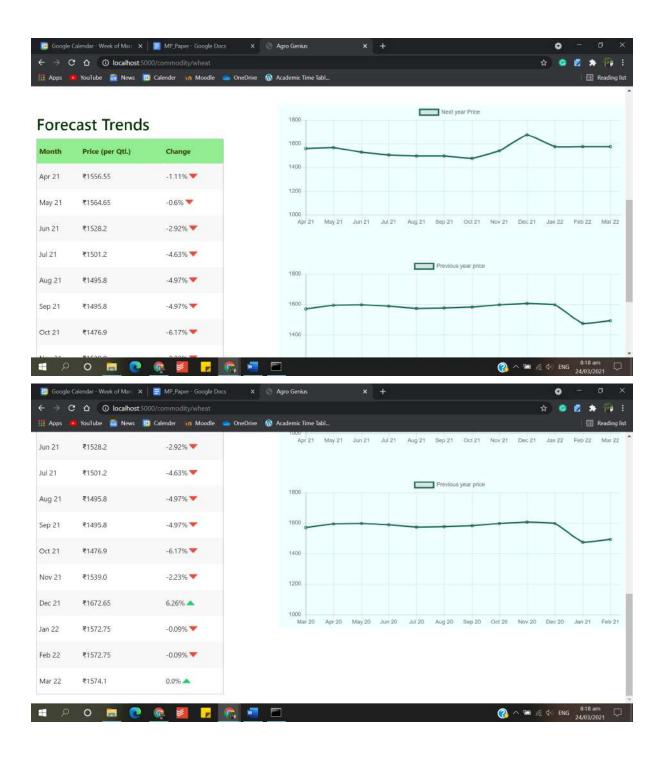**Explore crops page to see price prediction by clicking on crop**
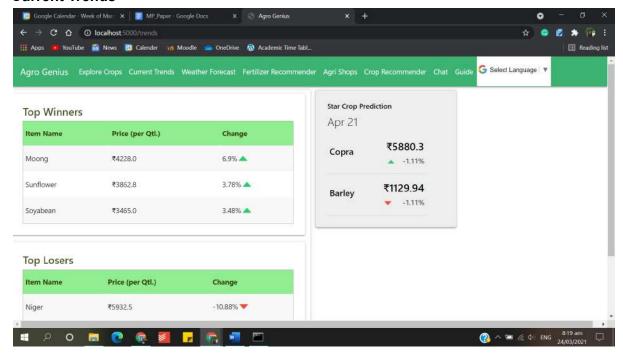
Selecting Wheat to check its price prediction
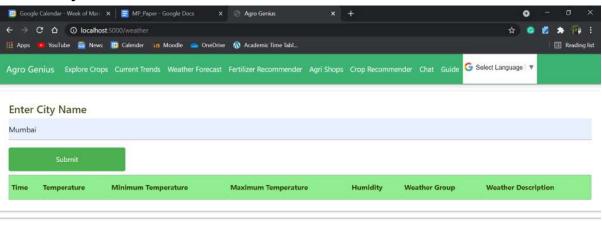

Wheat Commodity page

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% ▼

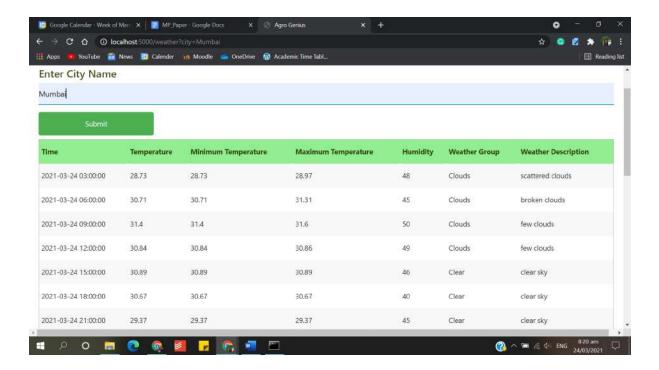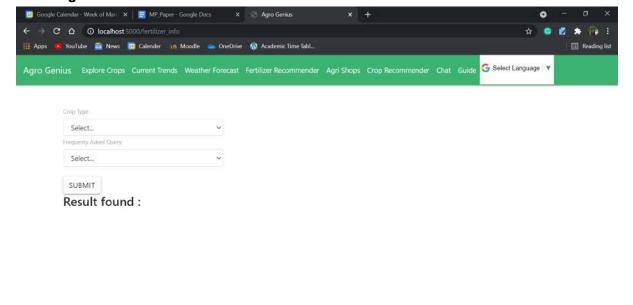| Month	Price (per Qtl.)	Change
Jun 21	₹1528.2	-2.92% ▼
Jul 21	₹1501.2	-4.63% ▼
Aug 21	₹1495.8	-4.97% ▼
Sep 21	₹1495.8	-4.97% ▼
Oct 21	₹1476.9	-6.17% ▼
Nov 21	₹1539.0	-2.23% ▼
Dec 21	₹1672.65	6.26% ▲
Jan 22	₹1572.75	-0.09% ▼
Feb 22	₹1572.75	-0.09% ▼
Mar 22	₹1574.1	0.0% ▲

Current Trends

Weather Forecast page. Enter city name to gets its weather prediction for 5 days with 3 hours delay
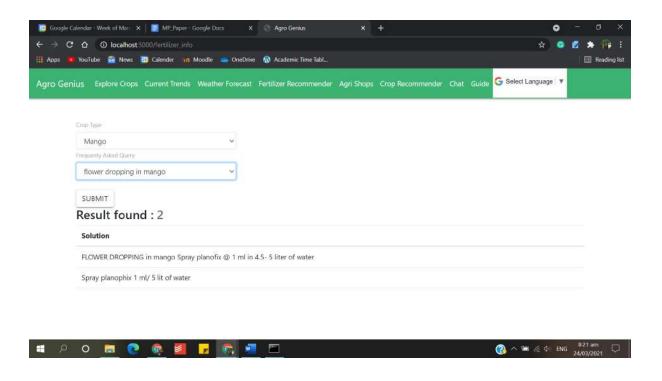
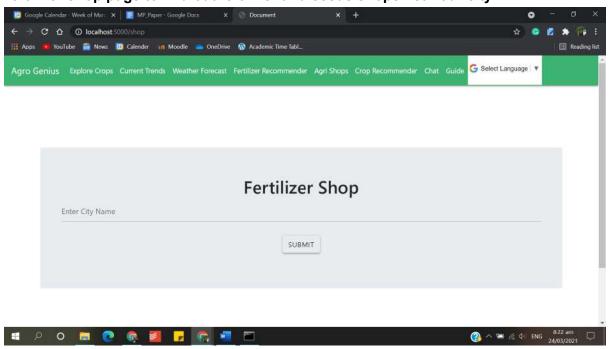**Fertilizer Recommender Page. Enter Crop Type and Query that the selected crop is suffering from.**

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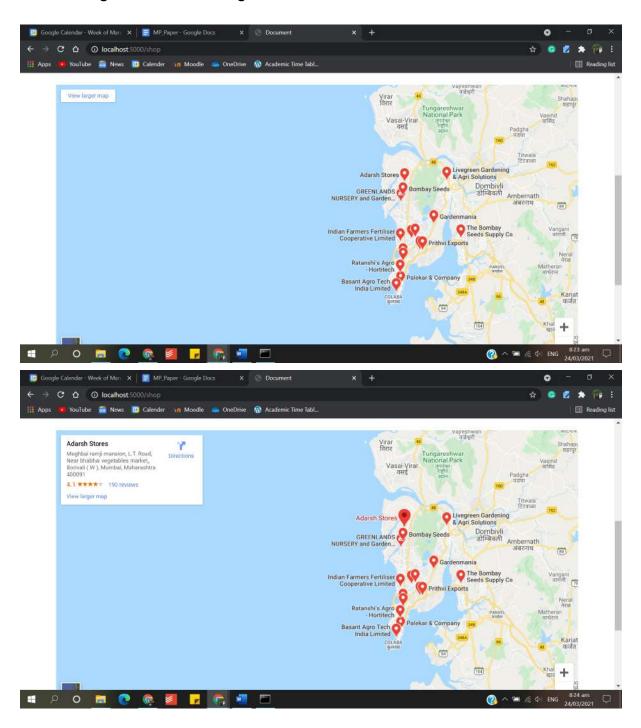
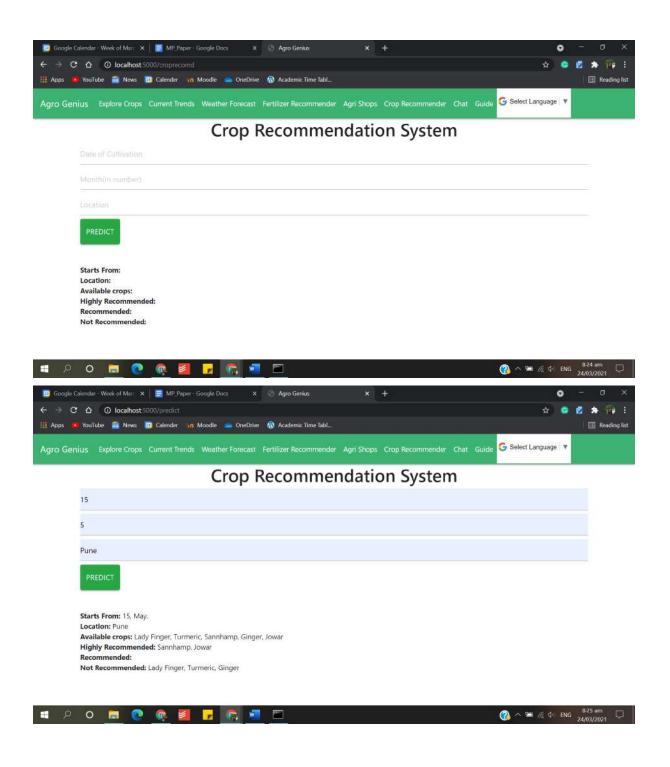**Fertilizer shop page to find out fertilizer and seeds shops near our city.**

Entering city name (Mumbai), we get the map with marker as fertilizer and seeds shop
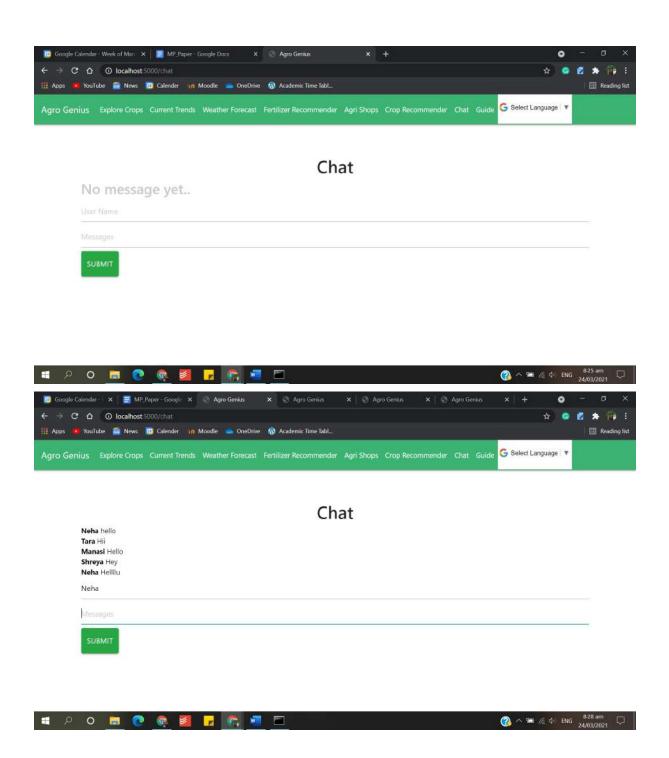
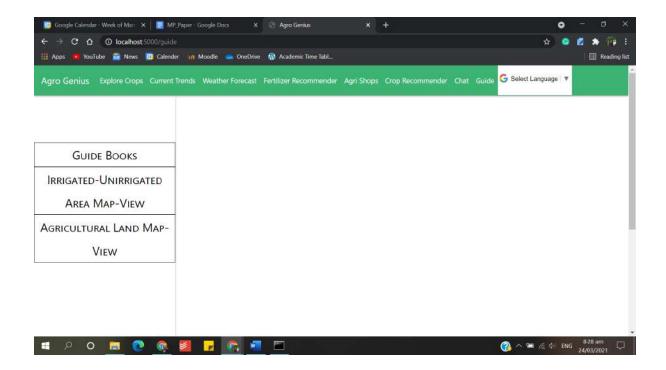**after clicking on the marker we get the address of the same.**

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.

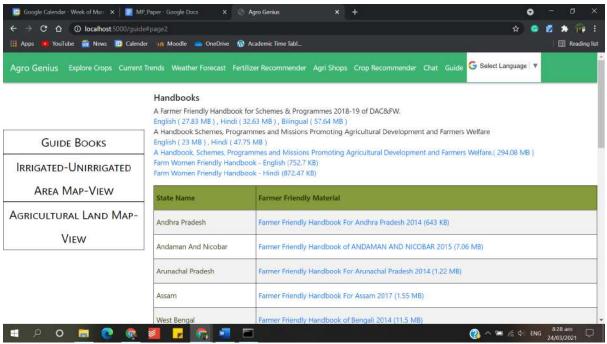**Chat Application page to contact with farmers.**
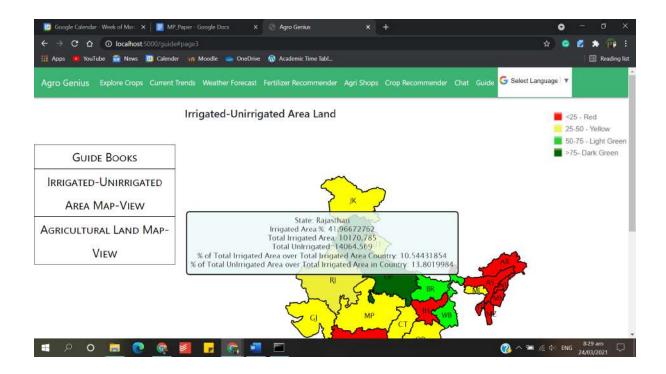
Guide Page for farmers who are new in this field
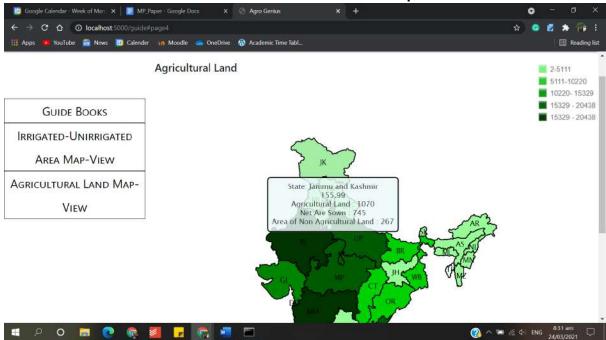
Handbooks with all information related to farming are present in this. Also, books are in state languages.

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

6.   References

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7.   Paper

7.1.   Conference/journal details

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