

AN MACHINE LEARNING BASED ON CROP RECOMMENDATION

Submitted in partial fulfillment of the
requirements for the award of
Bachelor of Engineering degree in Computer Science and Engineering

By

KOTHA SRI SAI ROHITH (40110635)
KODAVATI HEMANTH SAI SATYANARAYANA (40110601)



DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

SCHOOL OF COMPUTING

SATHYABAMA

**INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)**

Category-1 University by UGC

Accredited with Grade "A++" by NAAC

12B Status by UGC | Approved by AICTE

**JEPPIAAR NAGAR, RAJIV GANDHISALAI,
CHENNAI – 600119**

APRIL - 2024

SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY

(DEEMED TO BE UNIVERSITY)

Category - I University by UGC

Accredited "A++" by NAAC | Approved by AICTE

www.sathyabama.ac.in

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of Kotha Sri Sai Rohith(40110635), Kodavati Hemanth sai satyanarayana(40110601) who carried out the Project entitled "AN MACHINE LEARNING BASED ON CROP RECOMMENDATION" under my supervision from November 2023 to April 2024.



Internal Guide

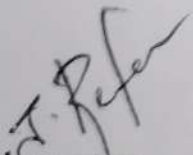
Dr. D. Poornima, M.E., Ph.D.

HEAD OF THE DEPARTMENT
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
SATHYABAMA

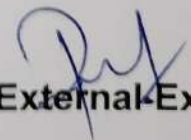
INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)

Dr. L. LAKSHMANAN, M.E., Ph.D.
Jennipaar Nagar, Rajiv Gandhi Salai,
Chennai - 600 119.

Submitted for Viva voce Examination held on 12-04-2024



Internal Examiner



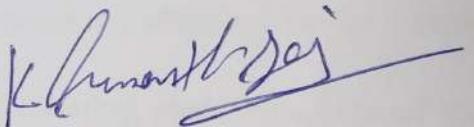
External Examiner

DECLARATION

I, KODAVATI HEMANTH SAI SATYANARAYANA (40110601), here by declare that the Project Report entitled "An Machine Learning Based on Crop Recommendation System" done by me under the guidance of Dr.D.Poornima.M.E.,Ph.D., is submitted in partial fulfillment of the requirements for the award of Bachelor of Engineering degree in **Computer Science and Engineering**.

DATE: 10-04-2024

PLACE: Chennai


SIGNATURE OF CANDITATE

ACKNOWLEDGEMENT

I am pleased to acknowledge my sincere thanks to **Board of Management of Sathyabama Institute Of Science And Technology** for their kind encouragement in doing this project and for completing it successfully. I am grateful to them.

I convey my thanks to **Dr. T.Sasikala M.E., Ph. D, Dean**, School of Computing, **Dr. L. Lakshmanan M.E., Ph.D.**, Head of the Department of Computer Science and Engineering for providing me necessary support and details at the right time during the progressive reviews.

I would like to express my sincere and deep sense of gratitude to my Project Guide **Dr. D . Poornima, M.E.,P.hD**, for her valuable guidance, suggestions and constant encouragement paved way for the successful completion of my phase-1 project work.

I wish to express my thanks to all Teaching and Non-teaching staff members of the **Department of Computer Science and Engineering** who were helpful in many ways for the completion of the project.

ABSTRACT

As a coastal state, faces uncertainty in agriculture which decreases its production. With more population and area, more productivity should be achieved but it cannot be reached. Farmers have words-of-mouth in past decades but now it cannot be used due to climatic factors. Agricultural factors and parameters make the data to get insights about the Agri-facts. Growth of IT world drives some highlights in Agriculture Sciences to help farmers with good agricultural information. Intelligence of applying modern technological methods in the field of agriculture is desirable in this current scenario. Machine Learning Techniques develops a well-defined model with the data and helps us to attain predictions. Agricultural issues like crop prediction, rotation, water requirement, fertilizer requirement and protection can be solved. Due to the variable climatic factors of the environment, there is a necessity to have a efficient technique to facilitate the crop cultivation and to lend a hand to the farmers in their production and management. This may help upcoming agriculturalists to have a better agriculture. A system of recommendations can be provided to a farmer to help them in crop cultivation with the help of data mining. To implement such an approach, crops are recommended based on its climatic factors and quantity. Data Analytics paves a way to evolve useful extraction from agricultural database. Crop Dataset has been analyzed and recommendation of crops is done based on productivity and season.

Chapter No	TITLE	Page No.
	ABSTRACT	v
	LIST OF FIGURES	viii
1	INTRODUCTION	09
2	LITERATURE SURVEY	10
	2.1 Inferences From The Literature Survey	10
3	REQUIREMENT ANALYSIS	15
	3.1 Aim and Scope	15
	3.2 Risk Analysis of the Project	15
	3.3 Requirement specification	16
	3.4 Existing System	18
4	DESCRIPTION PROPOSED SYSTEM	19
	4.1 System Architecture	19
	4.2 Use Case Diagram	20
	4.3 Sequence Diagram	21
	4.4 Activity Diagram	22
	4.5 Data flow Diagram	23
5	IMPLEMENTATION DETAILS	24
	5.1 Modules	24
	5.1.1 Data Collection	24
	5.1.2 Data Set	24
	5.1.3 Data Preparation	25

	5.1.4 Data Module	25
	5.2 System Testing	26
6	RESULT AND DISCUSSION	30
7	CONCLUSION	31
	REFERENCE	32
	APPENDIX	33
	A.SOURCE CODE	34
	B.SCREENSHOTS	42
	C.RESEARCH PAPER	46
	D.CONFERENCE CERTIFICATE	52

LIST OF FIGURES

CHAPTER		PAGE
NO.	FIGURE NAME	NO.
4.1.1	System Architecture	19
4.2.1	Use Case diagram	20
4.3.1	Sequence Diagram	21
4.4.1	Activity Diagram	22
4.5.1	Data flow Diagram	23
B.1	Open page	42
B.2	Login Page	43
B.3	Upload Page	44
B.4	Crop Prediction	44
B.5	Result for crop recommendation	45

CHAPTER 1

INTRODUCTION

Agriculture has an extensive history in India. Recently, India is ranked second in the farm output worldwide. Agriculture-related industries such as forestry and fisheries contributed for 16.6% of 2009 GDP and around 50% of the total workforce. Agriculture's monetary contribution to India's GDP is decreasing. The crop yield is the significant factor contributing in agricultural monetary. The crop yield depends on multiple factors such as climatic, geographic, organic, and financial elements. It is difficult for farmers to decide when and which crops to plant because of fluctuating market prices. Citing to Wikipedia figures India's suicide rate ranges from 1.4-1.8% per 100,000 populations, over the last 10 years. Farmers are unaware of which crop to grow, and what is the right time and place to start due to uncertainty in climatic conditions. The usage of various fertilizers is also uncertain due to changes in seasonal climatic conditions and basic assets such as soil, water, and air. In this scenario, the crop yield rate is steadily declining. The solution to the problem is to provide a smart user-friendly recommender system to the farmers. The crop yield prediction is a significant problem in the agriculture sector. Every farmer tries to know crop yield and whether it meets their expectations, thereby evaluating the previous experience of the farmer on the specific crop predict the yield. Agriculture yields rely primarily on weather conditions, pests, and preparation of harvesting operations. Accurate information on crop history is critical for making decisions on agriculture risk management. In this paper, we have proposed a model that addresses these issues. The novelty of the proposed system is to guide the farmers to maximize the crop yield as well as suggest the most profitable crop for the specific region. The proposed model provides crop selection based on economic and environmental conditions, and benefit to maximize the crop yield that will subsequently help to meet the increasing demand for the country's food supplies. The proposed model predicts the crop yield by studying factors such as rainfall, temperature, area, season, soil type etc. The system also helps to determine the best time to use fertilizers. The existing system which recommends crop yield is either hardware-based being costly to maintain, or not easily accessible.

CHAPTER 2

LITERATURE SURVEY

1. A Review on Data Mining Techniques for Fertilizer Recommendation,2018

To keep up nutrition levels in the soil in case of deficiency, fertilizers are added to soil. The standard issue existing among the Indian agriculturists choose approximate amount of fertilizers and add them manually. Excess or deficient extension of fertilizers can harm the plants life and reduce the yield. This paper gives overview of various data mining frameworks used on cultivating soil dataset for fertilizer recommendation.

2. A Survey on Data Mining Techniques in Agriculture,2017

Agriculture is the most critical application area especially in the developing nations like India .Use of information technology in agriculture can change the situation of decision making and farmers can yield in better way. Data mining plays a important role in decision making on several aspects with agriculture field. It examines about role of data mining in the farming field and their related work by a few authors in related to agriculture domain. It additionally talks about on various data mining applications in taking care of the several agriculture problems. This paper integrates the work of several authors in a single place so it is valuable for specialists to get data of current situation of data mining systems and applications in context to farming field.

3. AgroNutri Android Application,2016

This paper communicates the idea regarding the making of AgroNutri an android application that helps in conveying the harvest particular fertilizer amount to be applied. The idea is to calculate the measure of NPK composts to be applied depend on the blanked proposal of the crop of interest. This application works depend on the product chosen by the farmer and that is taken as input, thus providing the farmers. The future scope of the AgroNutri is that GPRS can be included so that according to location nutrients are suggested. Further this application would be incorporated as a piece of the accuracy agriculture wherein sensors can be utilized to discover the measure of NPK present in the dirt and that sum can be deducted

from the suggestion and giving us the exact measure of supplements to be added.

4. Machine Learning: Applications in Indian Agriculture,2016

Agriculture is a field that has been lacking from adaption of technologies and their advancements. Indian agriculturists should be up to the mark with the universal procedures. Machine learning is a native concept that can be applied to every field on all inputs and outputs. It has effectively settled its ability over ordinary calculations of software engineering and measurements. Machine learning calculations have improved the exactness of artificial intelligence machines including sensor based frameworks utilized in accuracy farming. This paper has evaluated the different uses of machine learning in the farming area. It additionally gives a knowledge into the inconveniences looked by Indian farmers and how they can be resolved using these procedures.

5. Impacts of population growth, economic development, and technical change on global food production and consumption,2015

Throughout the following decades humanity will request more food from less land and water assets. This investigation evaluates the food production effects of four elective advancement situations from the Millennium Ecosystem Assessment and the Special Report on Emission Scenarios. partially and jointly considered are land and water supply impacts from population development, and specialized change, and forests and agriculture demand request shifts from population development and economic improvement. The income impacts on nourishment request are registered with dynamic flexibilities. Worldwide farming area increments by up to 14% somewhere in the range of 2010 and 2030. Deforestation restrictions strongly impact the price of land and water resources but have little consequences for the global level of food production and food prices. While projected income changes have the highest partial impact on per capita food consumption levels, population growth leads to the highest increase in total food production. The impact of technical change is amplified or mitigated by adaptations of land management intensities

6. Brief history of agricultural systems modelling,2016

Rural frameworks science creates information that enables analysts to consider complex issues or take educated farming choices. The rich history of this science represents the decent variety of frameworks and scales over which they work and have been contemplated. Demonstrating, a basic apparatus in agrarian frameworks science, has been expert by researchers from an extensive variety of controls, who have contributed ideas and instruments over six decades. As agrarian researchers currently consider the "people to come" models, information, and learning items expected to meet the inexorably mind boggling frameworks issues looked by society, it is vital to check out this history and its exercises to guarantee that we stay away from re-innovation and endeavor to think about all elements of related difficulties. To this end, we outline here the historical backdrop of rural frameworks demonstrating and distinguish exercises discovered that can help control the structure and advancement of up and coming age of farming framework apparatuses and techniques. Various past occasions joined with generally innovative advancement in different fields have unequivocally added to the development of farming framework demonstrating, including improvement of process-based bio-physical models of yields and domesticated animals, factual models dependent on verifiable perceptions, and financial streamlining and reproduction models at family unit and local to worldwide scales. Attributes of rural frameworks models have changed broadly relying upon the frameworks included, their scales, and the extensive variety of purposes that spurred their advancement and use by specialists in various controls. Late patterns in more extensive joint effort crosswise over establishments, crosswise over orders, and between people in general and private segments recommend that the stage is set for the significant advances in rural frameworks science that are required for the up and coming age of models, databases, learning items and choice emotionally supportive networks. The exercises from history ought to be considered to help stay away from barricades and entanglements as the network builds up this up and coming age of horticultural frameworks models.

7. A Smart Agricultural Model by Integrating IoT, Mobile and Cloud-based Big Data Analytics, 2017

In the cultivating field, the system models play a significant role to the enhancement of the agro-normal and money related conditions. In the proportions of benefits of the field and farm examinations to give the information and to recognize fitting and fruitful organization practices. It can recognize the organization to arrive managers and transversely over reality as long as the required soil, the board, environment, and money related information. Decision Support Systems (DSSs) use to make the information for the vermin the board, develop the officials. These systems are not using the impelled strategies to process the data. Thusly, use the adroit system thoughts to take the decisions for the issue. It expect a crucial activity in the comprehension of agronomic results, and their use as decision sincerely steady systems for farmers is extending.

8. An Overview of Internet of Things and Data Analytics in Agriculture: Benefits and Challenges,2018

A blueprint of IoT and DA in agriculture has been shown in this paper. A couple of zones related to the association of IoT in agribusiness have been discussed in detail. The investigation of composing exhibits that there are clusters of work advancing being produced of IoT development that can be used to increase operational efficiency and gainfulness of plant and creatures. The benefits of IoT and DA, and open troubles have been identified and inspected in this paper. IoT is depended upon to offer a couple of benefits to the agribusiness division. Regardless, there are up 'til now different issues to be steered to make it moderate for close to nothing and medium-scale farmers. The key issues are security and cost. It is typical that as contention increases in the cultivating part

9. Circulation Mode Selection Based on Cost Analysis,2017

If every farmer and each average production base will join their optimal conditions in making cooperatives, it will accomplish economies of scale. Furthermore, producers will have an all the more favorable position in the plans with downstream firms (shipper or retailer).Second, the main customers of wholesale market are not

inhabitants nearby who buy small quantities products but lower distributors or retailers. More redesigned transportation mode respects intensive attempt of new agrarian things, which prompts bolster the movement of new chain joint logistics and strengthen resource utilize and made logistics advantage quality. Refresh everything considered agrarian things spread. By then, regard the examination of gigantic worth control of standard things and achieve the mind blowing control to stream process.

10. Support Vector Machine-based Fuzzy Self-learning Control for Induction Machines,2010

Using support vector machine (SVM) is to realize the self learning of fuzzy inference system (FIS), based on a fast modified varying metric method (MDFP) and a support vector machine identifier (SVMI), a SVM-FIS self-learning controller for the three phase induction machine adjustable speed system has been designed. The proposed controller is not only of the advantages that FIS does not depend on the plant model, strong robustness, and adaptive self-learning ability, but also learning ability and generalization performance of SVM. The designed processes of SVM-FIS, MDFP, and SVMI algorithms have been described in details. Simulation results show the feasibility, correctness and effectiveness of the proposed control strategy, such as the excellent static and dynamic performances, and strong anti-interference ability.

CHAPTER 3

REQUIREMENT ANALYSIS

3.1 AIM AND SCOPE

Our Aim from the project is to make a ML model which takes student data trains itself using various Machine Learning techniques and Algorithms(Random Forest, Decision Tree) and predict the yield and best fertilizer that suits for the crops in virtual environment by considering the overall factors that contribute in his overall yield. Secondly, to learn the required tech stacks and use it to make model with an python application and lastly to execute it get output about yield and best fertilizer for the crop. This Project can be used to get the student performance with more accuracy than any other model published earlier and we can also make some mobile or web application based on the model.

3.2 RISK ANALYSIS OF THE PROJECT

FEASIBILITY STUDY

The feasibility of the project is analyzed in this phase and business proposal is put forth with a very general plan for the project and some cost estimates. During system analysis the feasibility study of the proposed system is to be carried out. This is to ensure that the proposed system is not a burden to the company. For feasibility analysis, some understanding of the major requirements for the system is essential. The feasibility study investigates the problem and the information needs of the stakeholders. It seeks the resources required to provide an information systems solution, the cost and benefits of such a solution, and the feasibility of such a solution.

The goal of the feasibility study is to consider alternative information systems solutions, their feasibility, and propose the alternative most suitable to the organization. The feasibility of a proposed solution.

ECONOMICAL FEASIBILITY

This study is carried out to check the economic impact that the system will have on the organization. The amount of fund that the company can pour into the research and development of the system is limited. The expenditures must

justified. Thus the developed system as well within the budget and this was achieved because most of the technologies used are freely available. Only the customized products had to be purchased.

TECHNICAL FEASIBILITY

This study is carried out to check the technical feasibility, that is, the technical requirements of the system. Any system developed must not have a high demand on the available technical resources. This will lead to high demands on the available technical resources. This will lead to high demands being placed on the client. The developed system must have a modest requirement, as only minimal or null changes are required for implementing this system.

SOCIAL FEASIBILITY

The aspect of study is to check the level of acceptance of the system by the user. This includes the process of training the user to use the system efficiently. The user must not feel threatened by the system, instead must accept it as a necessity.

3.2 REQUIREMENT SPECIFICATION

FUNCTIONAL REQUIREMENTS

It is a technical specification requirement for the software products. It is the first step in the requirement analysis process which lists the requirements of particular software systems including functional, performance and security requirements. The function of the system depends mainly on the quality hardware used to run the software with given functionality.

Usability

It specifies how easy the system must be use. It is easy to ask queries in any format which is short or long, porter stemming algorithm stimulates the desired response for user.

Robustness

It refers to a program that performs well not only under ordinary conditions but also under unusual conditions. It is the ability of the user to cope with errors for irrelevant queries during execution.

Security

The state of providing protected access to resource is security. The system provides good security and unauthorized users cannot access the system there by providing high security.

Reliability

It is the probability of how often the software fails. The measurement is often expressed in MTBF (Mean Time between Failures). The requirement is needed in order to ensure that the processes work correctly and completely without being aborted. It can handle any load and survive and survive and even capable of working around any failure.

Compatibility

It is supported by version above all web browsers. Using any web servers like localhost makes the system real-time experience.

Flexibility

The flexibility of the project is provided in such a way that is has the ability to run on different environments being executed by different users.

Safety

Safety is a measure taken to prevent trouble. Every query is processed in a secured manner without letting others to know one's personal information.

NON- FUNCTIONAL REQUIREMENTS**Portability**

It is the usability of the same software in different environments. The project can be run in any operating system.

Performance

These requirements determine the resources required, time interval, throughput and everything that deals with the performance of the system.

Accuracy

The result of the requesting query is very accurate and high speed of retrieving information. The degree of security provided by the system is high and effective.

Maintainability

Project is simple as further updates can be easily done without affecting its stability. Maintainability basically defines that how easy it is to maintain the system. It means that how easy it is to maintain the system, analyse, change and test the application. Maintainability of this project is simple as further updates can be easily done without affecting its stability.

HARDWARE REQUIREMENTS

- System - Pentium-IV
- Speed - 2.4GHZ
- Hard disk - 40GB
- Monitor - 15VGA color
- RAM - 512MB

SOFTWARE REQUIREMENTS

- Operating system : Windows XP
- Coding Language : Python

3.3 EXISTING SYSTEM

The computational and data demands of structural price forecasting generally far exceed than what is routinely available in developing countries. Consequently, researchers often rely on parsimonious representations of price processes for their forecasting needs. Contemporary parsimonious form of price forecasting relies heavily on time series modelling. In time series modelling, past observations of the same variable are collected and analyzed to develop a model describing the underlying relationship. During the past few decades, much effort has been devoted to the development and improvement of time series forecasting models.

CHAPTER 4

DESCRIPTION OF PROPOSED SYSTEM

4.1 SYSTEM ARCHITECTURE

A system architecture is a conceptual model using which we can define the structure and behaviour of that system. It is a formal representation of a system. Depending on the context, system architecture can be used to refer to either a model to describe the system or a method used to build the system. Building a proper system architecture helps in analysis of the project, especially in the early stages.

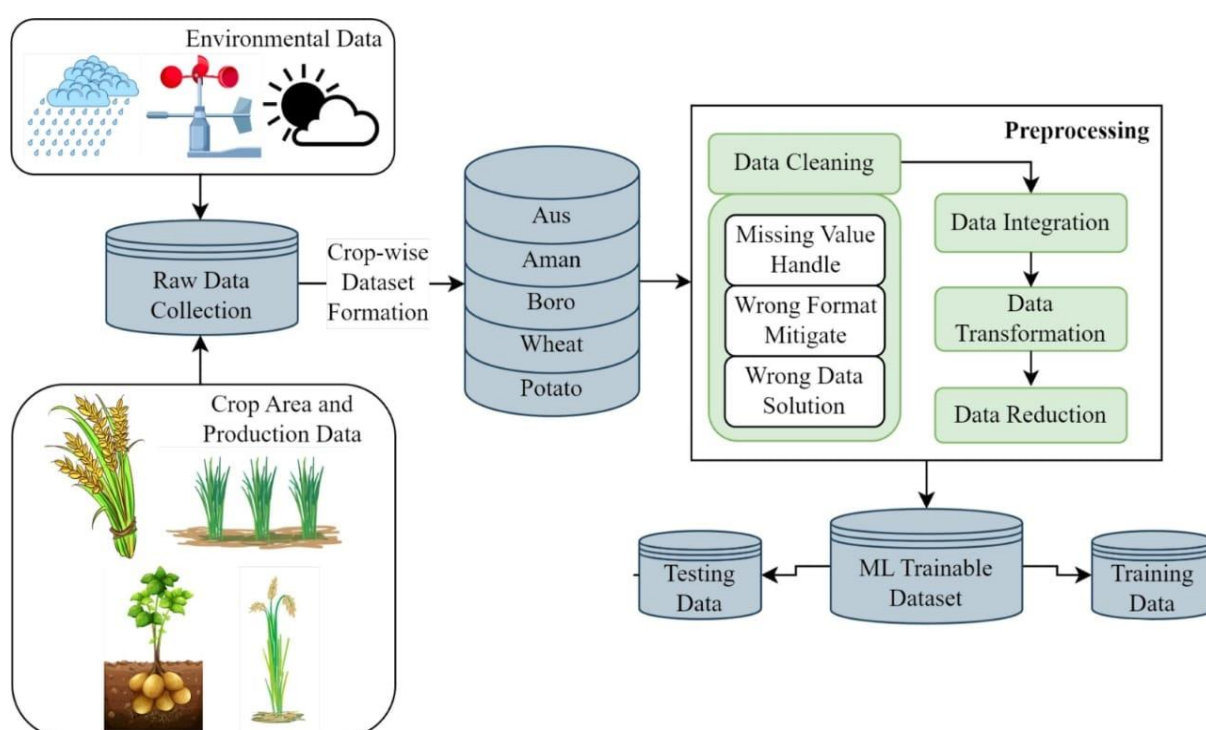


Fig 4.1.1 System Architecture

4.2 USE CASE DIAGRAM:

A use case diagram in the Unified Modeling Language (UML) is a type of behavioral diagram defined by and created from a Use-case analysis. Its purpose is to present a graphical overview of the functionality provided by a system in terms of actors, their goals (represented as use cases), and any dependencies between those use cases. The main purpose of a use case diagram is to show what system functions are performed for which actor. Roles of the actors in the system can be depicted.

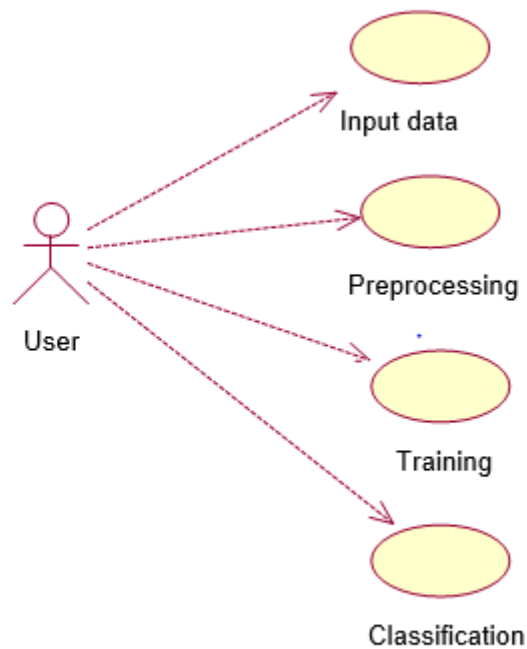


Fig 4.2.1 Use Case Diagram

4.3 SEQUENCE DIAGRAM:

A sequence diagram in Unified Modeling Language (UML) is a kind of interaction diagram that shows how processes operate with one another and in what order. It is a construct of a Message Sequence Chart. Sequence diagrams are sometimes called event diagrams, event scenarios, and timing diagram

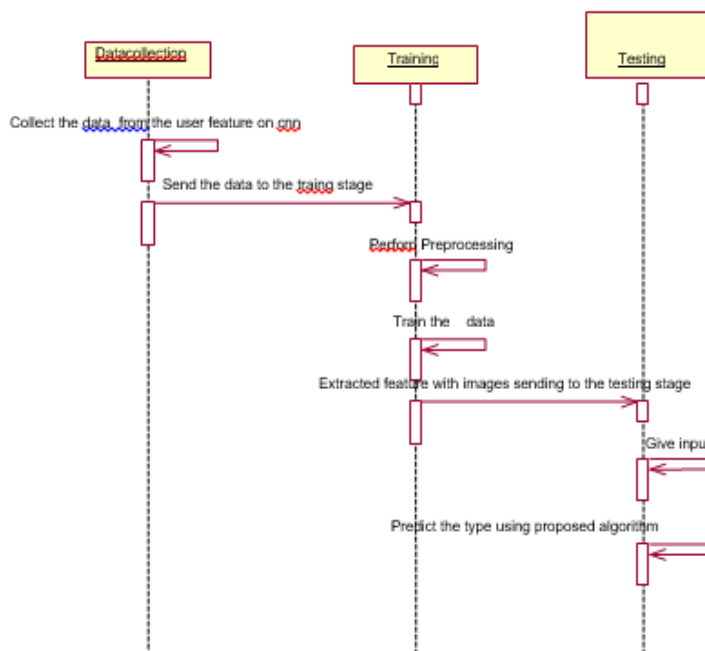


Fig 4.3.1 Sequence Diagram

4.4 ACTIVITY DIAGRAM:

Activity diagrams are graphical representations of workflows of stepwise activities and actions with support for choice, iteration and concurrency. In the Unified Modeling Language, activity diagrams can be used to describe the business and operational step-by-step workflows of components in a system. An activity diagram shows the overall flow of control.

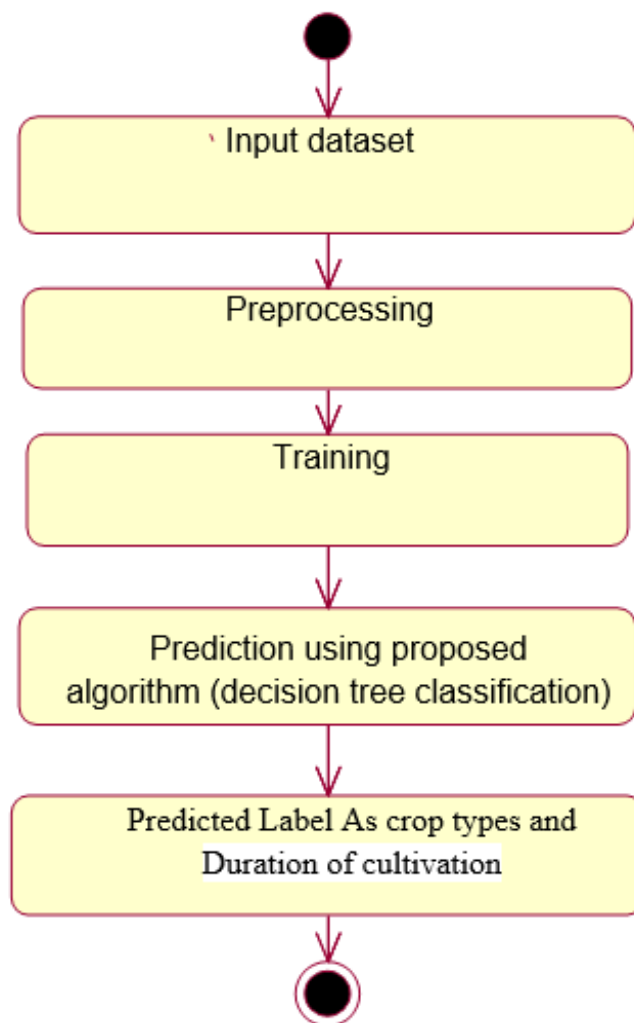


Fig 4.4.1 Activity Diagram

4.5 DATA FLOW DIAGRAM:

1. The DFD is also called as bubble chart. It is a simple graphical formalism that can be used to represent a system in terms of input data to the system, various processing carried out on this data, and the output data is generated by this system.
2. The data flow diagram (DFD) is one of the most important modeling tools. It is used to model the system components. These components are the system process, the data used by the process, an external entity that interacts with the system and the information flows in the system.
3. DFD shows how the information moves through the system and how it is modified by a series of transformations. It is a graphical technique that depicts information flow and the transformations that are applied as data moves from input to output.

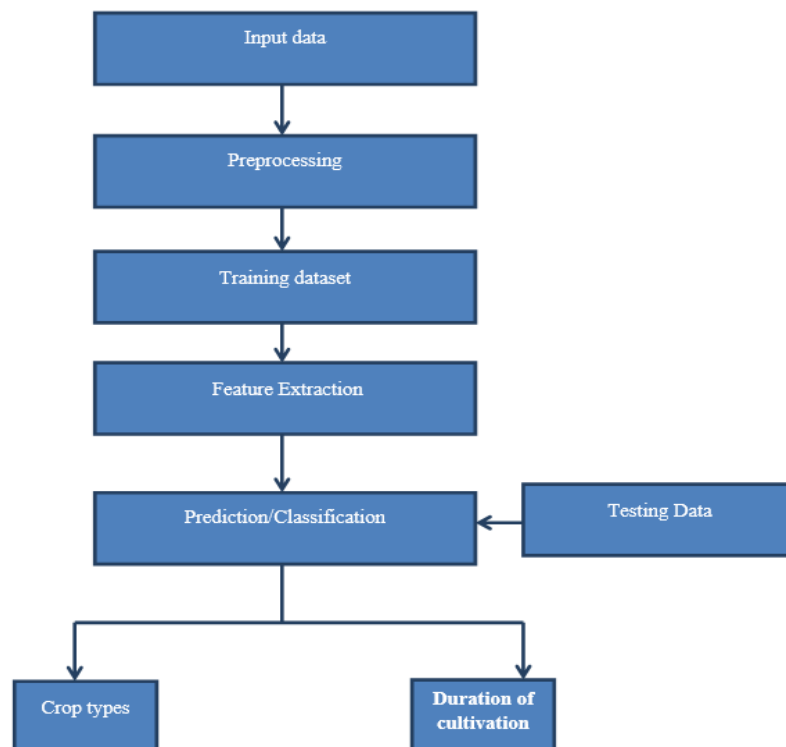


Fig :4.5.1 Data Flow Diagram

CHAPTER 5

IMPLEMENTATION DETAILS

5.1 MODULES

- Data Collection
- Dataset
- Data Preparation
- Model Selection
- Analyze and Prediction
- Accuracy on test set
- Saving the Trained Model

5.1.1 Data Collection

This is the first real step towards the real development of a machine learning model, collecting data. This is a critical step that will cascade in how good the model will be, the more and better data that we get, the better our model will perform.

There are several techniques to collect the data, like web scraping, manual interventions and etc.

The dataset used in this crop recommendation in india taken from some other source.

5.1.2 Data Set

The dataset consists of 821 individual data. There are 14 columns in the dataset, which are described below.

1. **States**: total number of states in india
2. **Rainfall**: rainfall in mm
3. **Ground Water**: Total ground water level
4. **Temperature**: temperature in degree Celsius
5. **Soil type**: Number of soil types
6. **Season**: Which season is suitable for crops

7. **Crops**: Types of crops
8. **Fertilisers required** : Types of Fertilisers required
9. **Cost of cultivation**: Total cost for cultivation
10. **Expected revenues**: Total expected revenues
11. **Quantity of seeds per hectare**: seeds for quantity per hectare
12. **Duration of cultivation**: number of day for duration of cultivation
13. **Demand of crop**: demand of crop (High, low)
14. **Crops for mixed cropping**: which crop can mixed for cropping.

5.1.3 Data Preparation

Wrangle data and prepare it for training. Clean that which may require it (remove duplicates, correct errors, deal with missing values, normalization, data type conversions, etc.)

Randomize data, which erases the effects of the particular order in which we collected and/or otherwise prepared our data

Visualize data to help detect relevant relationships between variables or class imbalances (bias alert!), or perform other exploratory analysis

Split into training and evaluation sets

5.1.4 Model Selection

A decision tree is a flowchart-like tree structure where an internal node represents feature(or attribute), the branch represents a decision rule, and each leaf node represents the outcome. The topmost node in a decision tree is known as the root node. It learns to partition on the basis of the attribute value. It partitions the tree in recursively manner call recursive partitioning. This flowchart-like structure helps you in decision making. It's visualization like a flowchart diagram which easily mimics the human level thinking. That is why decision trees are easy to understand and interpret.

Decision Tree is a white box type of ML algorithm. It shares internal decision-making logic, which is not available in the black box type of algorithms such as Neural

Network. Its training time is faster compared to the neural network algorithm. The time complexity of decision trees is a function of the number of records and number of attributes in the given data. The decision tree is a distribution-free or non-parametric method, which does not depend upon probability distribution assumptions. Decision trees can handle high dimensional data with good accuracy.

The decision rules are generally in form of if-then-else statements. The deeper the tree, the more complex the rules and fitter the model.

Before we dive deep, let's get familiar with some of the terminologies:

- Instances: Refer to the vector of features or attributes that define the input space
- Attribute: A quantity describing an instance
- Concept: The function that maps input to output
- Target Concept: The function that we are trying to find, i.e., the actual answer
- Hypothesis Class: Set of all the possible functions
- Sample: A set of inputs paired with a label, which is the correct output (also known as the Training Set)
- Candidate Concept: A concept which we think is the target concept
- Testing Set: Similar to the training set and is used to test the candidate concept and determine its performance.

5.2 SYSTEM TESTING

Test plan

Software testing is the process of evaluation a software item to detect differences between given input and expected output. Also to assess the feature of a software item. Testing assesses the quality of the product. Software testing is a process that should be done during the development process

Verification

Verification is the process to make sure the product satisfies the conditions imposed at the start of the development phase. In other words, to make sure the product behaves the way we want it to.

Validation

Validation is the process to make sure the product satisfies the specified requirements at the end of the development phase. In other words, to make sure the product is built as per customer requirements.

Basics of software testing

There are two basics of software testing: black box testing and white box testing.

Black box Testing

Black box testing is a testing technique that ignores the internal mechanism of the system and focuses on the output generated against any input and execution of the system. It is also called functional testing.

White box Testing

White box testing is a testing technique that takes into account the internal mechanism of a system. It is also called structural testing and glass box testing. Black box testing is often used for validation and white box testing is often used for verification.

Types of testing

- Unit Testing
- Integration Testing
- Functional Testing
- System Testing
- Stress Testing
- Performance Testing
- Usability Testing
- Acceptance Testing
- Regression Testing
- Beta Testing

Unit Testing

Unit testing is the testing of an individual unit or group of related units. It falls under the class of white box testing. It is often done by the programmer to test that the unit he/she has implemented is producing expected output against given input.

Integration Testing

Integration testing is testing in which a group of components are combined to produce output. Also, the interaction between software and hardware is tested in integration testing if software and hardware components have any relation. It may fall under both white box testing and black box testing.

Functional Testing

Functional testing is the testing to ensure that the specified functionality required in the system requirements works. It falls under the class of black box testing.

System Testing

System testing is the testing to ensure that by putting the software in different environments (e.g., Operating Systems) it still works. System testing is done with full system implementation and environment.

Stress Testing

Stress testing is the testing to evaluate how system behaves under unfavorable conditions. Testing is conducted at beyond limits of the specifications. It falls under the class of black box testing.

Performance Testing

Performance testing is the testing to assess the speed and effectiveness of the system and to make sure it is generating results within a specified time as in performance requirements. It falls under the class of black box testing.

Usability Testing

Usability testing is performed to the perspective of the client, to evaluate how the GUI is user-friendly? How easily can the client learn? After learning how to use, how proficiently can the client perform? How pleasing is it to use its design? This falls under the class of black box testing.

Acceptance Testing

Acceptance testing is often done by the customer to ensure that the delivered product meets the requirements and works as the customer expected. It falls under the class of black box testing.

Regression Testing

Regression testing is the testing after modification of a system, component, or a group of related units to ensure that the modification is working correctly and is not damaging or imposing other modules to produce unexpected results. It falls under the class of black box testing

CHAPTER 6

Results and Discussion

6.1 RESULT:

In this project the data analysis technology is used to update the rate change through notification. Further, a ranking process is applied for decision making 33 in order to select the classifiers results. This system is used to predict the cost of the crop yield. The crop yield prediction is a significant problem in the agriculture sector. Every farmer tries to know crop yield and whether it meets their expectations, thereby evaluating the previous experience of the farmer on the specific crop predict the yield. Agriculture yields rely primarily on weather conditions, pests, and preparation of harvesting operations. Accurate information on crop history is critical for making decisions on agriculture risk management. In this paper, we have proposed a model that addresses these issues. The novelty of the proposed system is to guide the farmers to maximize the crop yield as well as suggest the most profitable crop for the specific region

6.2 DISCUSSIONS:

Moreover, discussions delved into the potential societal impacts and ethical considerations of deploying emotion-aware technologies in real-world contexts. Dialogues with domain experts and stakeholders highlighted the importance of responsible innovation and equitable access to technology, particularly in underserved communities and vulnerable populations. Concerns regarding algorithmic bias, data privacy, and digital inequality prompted nuanced discussions on governance frameworks and regulatory measures to safeguard user rights and promote inclusive development. By fostering interdisciplinary collaborations and engaging in participatory decision-making processes, we aim to address these complex socio-technical challenges and foster a culture of responsible innovation that prioritizes human values and societal well-being.

CHAPTER 7

CONCLUSION

This open attitude determines the degree and scope of information sharing. Big data analysis technology can effectively improve the crop yield production is updatation. This project proposes a novel intelligent system for agricultural crop price prediction. The key idea is to use ensemble of classifiers for prediction. The usage of ensemble of classifiers paves a path way to make a better decision on predictions due to the usage of multiple classifiers. Further, a ranking process is applied for decision making in order to select the classifiers results. This system is used to predict the cost of the crop rate for further. The solution will benefit farmers to maximize productivity in agriculture, reduce soil degradation in cultivated fields, and reduce fertilizer use in crop production by recommending the right crop by considering various attributes. This would provide a comprehensive prediction on the basis of geographical, environmental and economic aspects.

REFERENCES

- [1] Manpreet Kaur, Heena Gulati, Harish Kundra, "Data Mining in Agriculture on Crop Price Prediction: Techniques and Applications", International Journal of Computer Applications, Volume 99– No.12, August 2014.
- [2] J. Meng, "Research on the cost of agricultural products circulation and its control under the new normal economic development," Commercial Times, no. 23, pp. 145147, 2016.
- [3] A. Kaloxylou et al., "Farm management systems and the future Internet era," Comput. Electron. Agricult., vol. 89, pp. 130–144, Nov. 2012.
- [4] N. N. Li, T. S. Li, Z. S. Yu, Y. Rui, Y. Y. Miao, and Y. S. Li, "Factors influencing farmers' adoption of new technology based on Logistic-ISM model-a case study of potato planting technology in Dingxi City, Gansu Province," Progress in Geography, vol. 33, no. 4, pp. 542-551, 2014.
- [5] Y. Wang, "A neural network adaptive control based on rapid learning method and its application," Advances In Modeling and Analysis, Vol. 46(3), pp. 27-34, 1994.
- [6] Lakshmi.N, Priya.M, Sahana Shetty, and Manjunath C. R, Crop Recommendation System for Precision Agriculture, vol. 6 Reading, IND: International Journal for Research in Applied Science & Engineering Technology, 2018.
- [7] G. Chauhan and A. Chaudhary, "Crop recommendation system using machine learning algorithms", 2021 10th International Conference on System Modeling & Advancement in Research Trends (SMART), pp. 109-112, 2021, December.
- [8] Gandge, Yogesh. "A study on various data mining techniques for crop yield prediction." In 2017 International Conference on Electrical, Electronics, Communication, Computer, and Optimization Techniques (ICEECCOT), pp. 420-423. IEEE, 2017.
- [9] .Dighe, Deepti, Harshada Joshi, Aishwarya Katkar, Sneha Patil, and Shrikant Kokate. "Survey of Crop Recommendation Systems." (2018)
- [10] Sivanandhini, P.; Prakash, J. Crop Yield Prediction Analysis using Feed Forward and Recurrent Neural Network. *Int. J. Innov. Sci. Res. Technol.* **2020**, *5*, 1092–1096.

- [11] Sivanandhini, P.; Prakash, J. Crop Yield Prediction Analysis using Feed Forward and Recurrent Neural Network. *Int. J. Innov. Sci. Res. Technol.* **2020**, *5*, 1092–1096.
- [12] N. H. Kulkarni, G. N. Srinivasan, B. M. Sagar, and N. K. Cauvery, “Improving crop productivity through a crop recommendation system using ensembling technique,” in 2018 3rd International Conference on Computational Systems and Information Technology for Sustainable Solutions (CSITSS), 2018, pp. 114–119.
- [13] D. Reddy and M. R. Kumar, “Crop yield prediction using machine learning algorithm,” in 2021 5th International Conference on Intelligent Computing and Control Systems (ICICCS), 2021, pp. 1466–1470.
- [14] R. K. Rajak, A. Pawar, M. Pendke, P. Shinde, S. Rathod, and A. Devare, “Crop recommendation system to maximize crop yield using machine learning technique,” *International Research Journal of Engineering and Technology*, vol. 4, no. 12, pp. 950–953, 2017.
- [15] Z. Doshi, S. Nadkarni, R. Agrawal, and N. Shah, “Agroconsultant: Intelligent crop recommendation system using machine learning algorithms,” in 2018 Fourth International Conference on Computing Communication Control and Automation (ICCUBE), 2018.

APPENDIX

A.SOURCE CODE

```
import numpy as np
import pandas as pd
from flask import Flask, request, jsonify, render_template, redirect, flash, send_file
from sklearn.preprocessing import MinMaxScaler
from werkzeug.utils import secure_filename
import pickle

import numpy as np
import pandas as pd
from flask import Flask, request, jsonify, render_template, redirect, flash, send_file
from sklearn.preprocessing import MinMaxScaler
from werkzeug.utils import secure_filename
import pickle
import numpy as np
import pandas as pd
from sklearn.tree import DecisionTreeClassifier
from sklearn.ensemble import RandomForestClassifier, BaggingClassifier,
AdaBoostClassifier, VotingClassifier

app = Flask(__name__) #Initialize the flask App

#forest = pickle.load(open('boosting.pkl','rb'))
crop = pickle.load(open('crop.pkl','rb'))
@app.route('/')

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

```

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

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

#@app.route('/future')
#def future():
#    return render_template('future.html')

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

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

@app.route('/preview', methods=["POST"])
def preview():
    if request.method == 'POST':
        dataset = request.files['datasetfile']
        df = pd.read_csv(dataset, encoding = 'unicode_escape')
        df.set_index('Id', inplace=True)
        return render_template("preview.html", df_view = df)

#@app.route('/home')
#def home():
#    return render_template('home.html')

@app.route('/prediction', methods = ['GET', 'POST'])
def prediction():
    return render_template('prediction.html')

```

```

#@app.route('/upload')
#def upload_file():
#    return render_template('BatchPredict.html')

@app.route('/predict',methods=['POST'])
def predict():
    int_feature = [x for x in request.form.values()]

    final_features = [np.array(int_feature)]

    y_pred=crop.predict(final_features)

    if y_pred[0] == 'Paddy IGKVR-2 (IET 19795)':
        label="Crop: Paddy IGKVR-2 (IET 19795) Duration of cultivation: 105-123"
    elif y_pred[0] == 'Paddy CR Dhan 501 (IET 19189)':
        label="Crop: Paddy CR Dhan 501 (IET 19189) Duration of cultivation: 105-126"
    elif y_pred[0] == 'Wheat VL Gehun 907 (VL 907)':
        label="Crop: Wheat VL Gehun 907 (VL 907)) Duration of cultivation: 60-154"
    elif y_pred[0] == 'Wheat WHD 943':
        label="Crop: Wheat WHD 943 Duration of cultivation: 60-157"
    elif y_pred[0] == 'Millet Nandi-65 (MH-1549)':
        label="Crop: Millet Nandi-65 (MH-1549) Duration of cultivation: 65-70"
    elif y_pred[0] == 'Lentil Pant Lentil-8(Pant L-063)':
        label="Crop: Lentil Pant Lentil-8(Pant L-063) Duration of cultivation: 45-60"
    elif y_pred[0] == 'Bajra':
        label="Crop: Bajra Duration of cultivation: 45-50"
    elif y_pred[0] == 'Cardamom':
        label="Crop: Cardamom Duration of cultivation: 730-735"
    elif y_pred[0] == 'Urad':

```

```

        label="Crop: Urad Duration of cultivation: 70-85"
    elif y_pred[0] == 'Jowar':
        label="Crop: Jowar Duration of cultivation: 65-75"
    elif y_pred[0] == 'Paddy CR Dhan 401 (REETA)':
        label="Crop: Paddy CR Dhan 401 (REETA) Duration of cultivation:
105-124    "
    elif y_pred[0] == 'Millet MH 1540 (86M64) (Hybrid)':
        label="Crop: Millet MH 1540 (86M64) (Hybrid) Duration of cultivation:
65-73"
    elif y_pred[0] == 'Sugarcane Karan 5 (Co 0124)':
        label="Crop: Sugarcane Karan 5 (Co 0124) Duration of cultivation:
300-451"
    elif y_pred[0] == 'Banana':
        label="Crop: Banana Duration of cultivation: 365-370"
    elif y_pred[0] == 'Arhar':
        label="Crop: Arhar Duration of cultivation: 120-200"
    elif y_pred[0] == 'Clove':
        label="Crop: Clove Duration of cultivation: 120-180    "
    elif y_pred[0] == 'Oilseed':
        label="Crop: Oilseed Duration of cultivation: 110-115"
    elif y_pred[0] == 'Tea':
        label="Crop: Tea Duration of cultivation: 60-65"
    elif y_pred[0] == 'Coffee':
        label="Crop: Coffee Duration of cultivation: 240-270"
    elif y_pred[0] == 'Turmeric':
        label="Crop: Turmeric Duration of cultivation: 210-270"
    elif y_pred[0] == 'Cashewnut':
        label="Crop: Cashewnut Duration of cultivation: 1030-1035"
    elif y_pred[0] == 'Ragi':
        label="Crop: Ragi Duration of cultivation: 5.0-7.0"
    elif y_pred[0] == 'Soyabean':
        label="Crop: Soyabean Duration of cultivation: 45-65"
    elif y_pred[0] == 'Black Gram':

```

```

        label="Crop: Black Gram Duration of cultivation: 70-85"
    elif y_pred[0] == 'Khesari':
        label="Crop: Khesari Duration of cultivation: 125-130"
    elif y_pred[0] == 'Wheat MACS 6222':
        label="Crop: Wheat MACS 6222 Duration of cultivation: 60-151"
    elif y_pred[0] == 'Black Pepper':
        label="Crop: Black Pepper Duration of cultivation: 120-150"
    elif y_pred[0] == 'Chillies':
        label="Crop: Chillies Duration of cultivation: 40-45"
    elif y_pred[0] == 'Garlic':
        label="Crop: Garlic Duration of cultivation: 120-150"
    elif y_pred[0] == 'Wheat MPO(JW) 1215 (MPO 1215)':
        label="Crop: Wheat MPO(JW) 1215 (MPO 1215) Duration of
cultivation: 60-150"
    elif y_pred[0] == 'Maize PMH 5 (JH 3110)':
        label="Crop: Maize PMH 5 (JH 3110) Duration of cultivation: 95-105"
    elif y_pred[0] == 'Groundnut Kadiri Harithandhra (K 1319)':
        label="Crop: Groundnut Kadiri Harithandhra (K 1319) Duration of
cultivation: 110-121"
    elif y_pred[0] == 'Groundnut GPBD 5':
        label="Crop: Groundnut GPBD 5 Duration of cultivation: 110-122"
    elif y_pred[0] == 'Lentil Pant Lentil-7(Pant L-024)':
        label="Crop: Lentil Pant Lentil-7(Pant L-024) Duration of cultivation:
45-61"
    elif y_pred[0] == 'Tobacco':
        label="Crop: Tobacco Duration of cultivation: 90-120"
    elif y_pred[0] == 'Tomato':
        label="Crop: Tomato Duration of cultivation: 50-60"
    elif y_pred[0] == 'Cocoa':
        label="Crop: Cocoa Duration of cultivation: 150-180"
    elif y_pred[0] == 'Rubber':
        label="Crop: Rubber Duration of cultivation: 120-130"
    elif y_pred[0] == 'Masoor':

```

```

        label="Crop: Masoor Duration of cultivation: 120-130"
elif y_pred[0] == 'Sunhemp':
        label="Crop: Sunhemp Duration of cultivation: 60-90"
elif y_pred[0] == 'Varagu':
        label="Crop: Varagu Duration of cultivation: 160-165"
elif y_pred[0] == 'Paddy CR Dhan 601 (IET 18558)':
        label="Crop: Paddy CR Dhan 601 (IET 18558) Duration of cultivation:
105-125"
elif y_pred[0] == 'Wheat Netravati (NIAW 1415)':
        label="Crop: Wheat Netravati (NIAW 1415) Duration of cultivation: 95-
100"
elif y_pred[0] == 'Maize HSC1':
        label="Crop: Maize HSC1 Duration of cultivation: 95-100"
elif y_pred[0] == 'Millet Nandi-61 (MH-1548)':
        label="Crop: Millet Nandi-61 (MH-1548) Duration of cultivation: 65-71"
elif y_pred[0] == 'Millet 86M64 (MSH 203) (Hybrid)':
        label="Crop: Millet 86M64 (MSH 203) (Hybrid) Duration of cultivation:
65-72"
elif y_pred[0] == 'Barley Pusa Losar (BH- 380)':
        label="Crop: Barley Pusa Losar (BH- 380) Duration of cultivation: 60-
72"
elif y_pred[0] == 'Maize DHM 119 (BH 4062)':
        label="Crop: Maize DHM 119 (BH 4062) Duration of cultivation: 95-
103"
elif y_pred[0] == 'Millet HHB 226 (MH 1479)':
        label="Crop: Millet HHB 226 (MH 1479) Duration of cultivation: 65-76"
elif y_pred[0] == 'Jute':
        label="Crop: Jute Duration of cultivation: 120-150"
elif y_pred[0] == 'Paddy Chinsurah Rice (IET 19140)':
        label="Crop: Paddy Chinsurah Rice (IET 19140) Duration of
cultivation: 105-120"
elif y_pred[0] == 'Paddy (CNI 383-5-11)':
        label="Crop: Paddy (CNI 383-5-11) Duration of cultivation: 105-121"

```

```

elif y_pred[0] == 'Paddy IGKVR-1 (IET 19569)':
    label="Crop: Paddy IGKVR-1 (IET 19569) Duration of cultivation: 105-
122"
elif y_pred[0] == 'Onion':
    label="Crop: Onion Duration of cultivation: 80-150"
elif y_pred[0] == 'Cotton CNH012':
    label="Crop: Cotton CNH012 Duration of cultivation: 80-150"
elif y_pred[0] == 'Cotton CICR-3 (CISA 614)':
    label="Crop: Cotton CICR-3 (CISA 614) Duration of cultivation: 105-
120"
elif y_pred[0] == 'Rice':
    label="Crop: Rice Duration of cultivation: 105-120"
elif y_pred[0] == 'Flax':
    label="Crop: Flax Duration of cultivation: 120-140"
elif y_pred[0] == 'Barley BH-902':
    label="Crop: Barley BH-902 Duration of cultivation: 60-70"
elif y_pred[0] == 'Sunflower':
    label="Crop: Sunflower Duration of cultivation: 90-100"
elif y_pred[0] == 'Maize HQPM-4':
    label="Crop: Maize HQPM-4 Duration of cultivation: 95-101"
elif y_pred[0] == 'Groundnut Girnar - 3 (PBS 12160)':
    label="Crop: Groundnut Girnar - 3 (PBS 12160) Duration of cultivation:
175-180"
elif y_pred[0] == 'Dry Ginger':
    label="Crop: Dry Ginger Duration of cultivation: 175-180"
elif y_pred[0] == 'Horse Gram':
    label="Crop: Horse Gram Duration of cultivation: 120-180"
elif y_pred[0] == 'Castor Seed':
    label="Crop: Castor Seed Duration of cultivation: 7.0-10"
elif y_pred[0] == 'Sesame':
    label="Crop: Sesame Duration of cultivation: 40-45"
elif y_pred[0] == 'Sugarcane Karan 6 (Co 0239)':
    label="Crop: Sugarcane Karan 6 (Co 0239) Duration of cultivation:

```

300-450"

```
    elif y_pred[0] == 'Peas':
        label="Crop: Peas Duration of cultivation: 50-100"
    elif y_pred[0] == 'Paddy RC Maniphou 11 (IET 20193)':
        label="Crop: Paddy RC Maniphou 11 (IET 20193) Duration of
cultivation: 105-127"
    elif y_pred[0] == 'Cowpea':
        label="Crop: Cowpea Duration of cultivation: 45-90"
    elif y_pred[0] == 'Maize MCH 36 (Hybrid) (DKC 9099)':
        label="Crop: Maize MCH 36 (Hybrid) (DKC 9099) Duration of
cultivation: 95-102"
    elif y_pred[0] == 'Pulses':
        label="Crop: Pulses Duration of cultivation: 95-102"
    elif y_pred[0] == 'Sugarcane Co-0218':
        label="Crop: Sugarcane Co-0218 Duration of cultivation: 300-452"
    elif y_pred[0] == 'Wheat PDW 314':
        label="Crop: Wheat PDW 314 Duration of cultivation: 60-152"
    elif y_pred[0] == 'Sweet potato':
        label="Crop: Sweet potato Duration of cultivation: 120-125"
    elif y_pred[0] == 'Cotton VBCH 2231':
        label="Crop: Cotton VBCH 2231 Duration of cultivation: 150-180"

    return render_template('prediction.html', prediction_text=label)
#@app.route('/performance')
#def performance():
    return render_template('performance.html')
if __name__ == "__main__":
    app.run(debug=True)
```

B.SCREENSHOTS

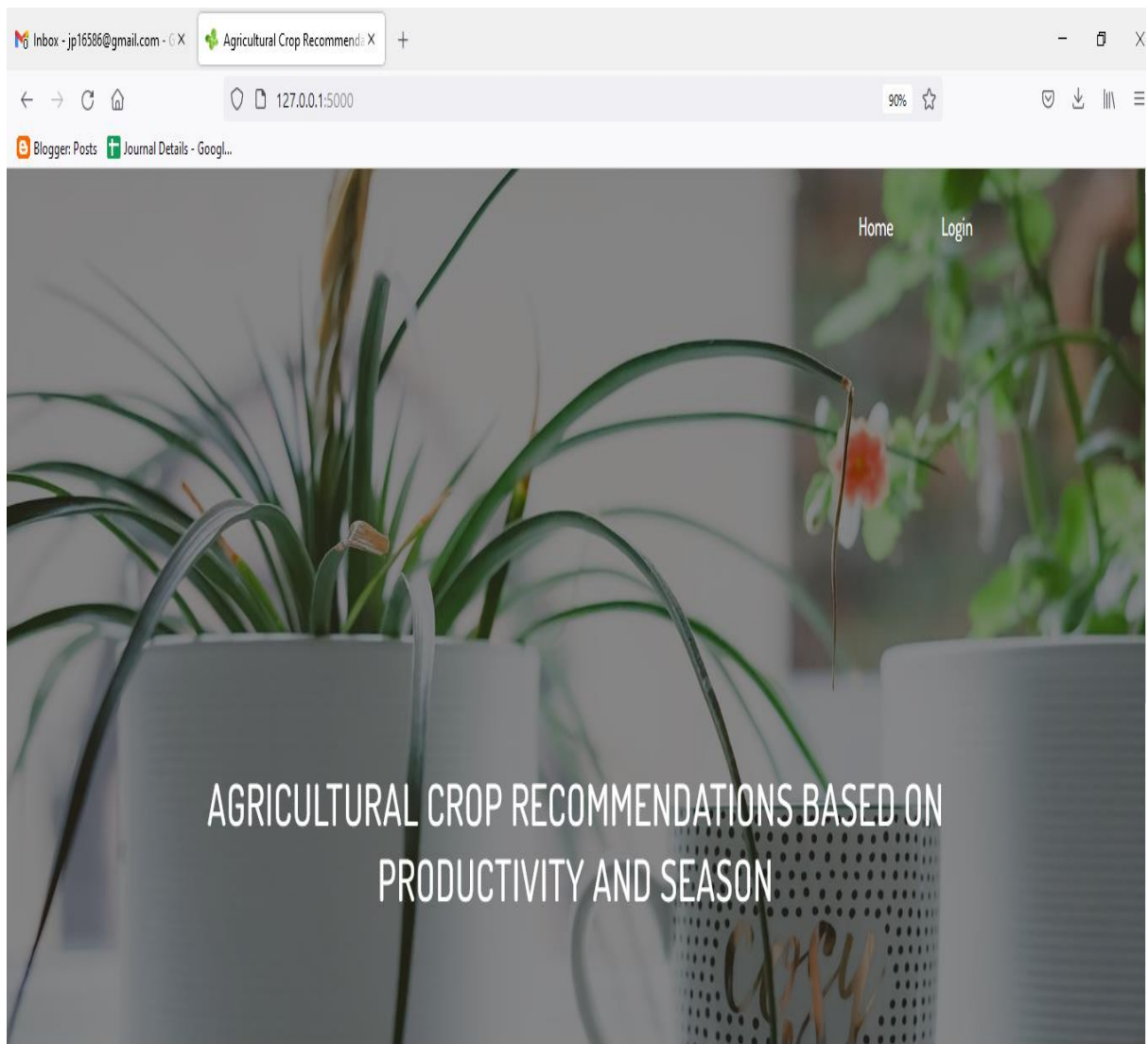


Fig:B.1 Open page

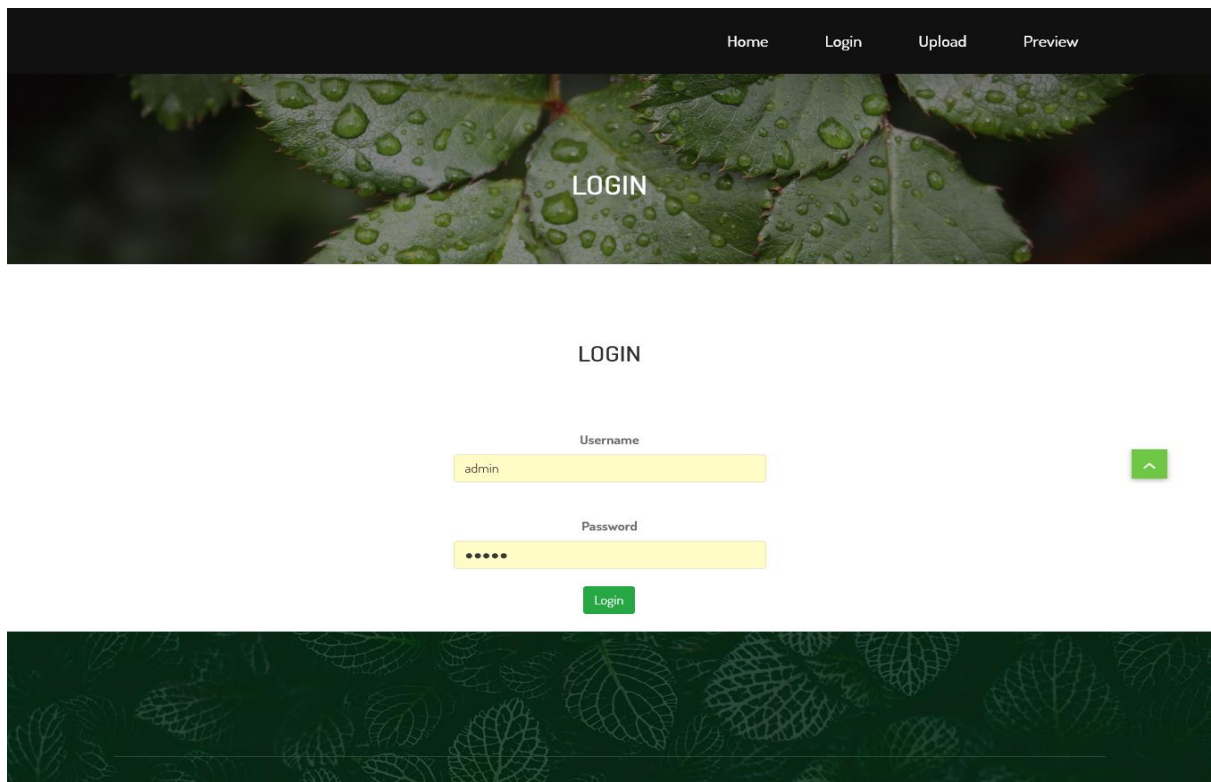


Fig:B.2 Login page

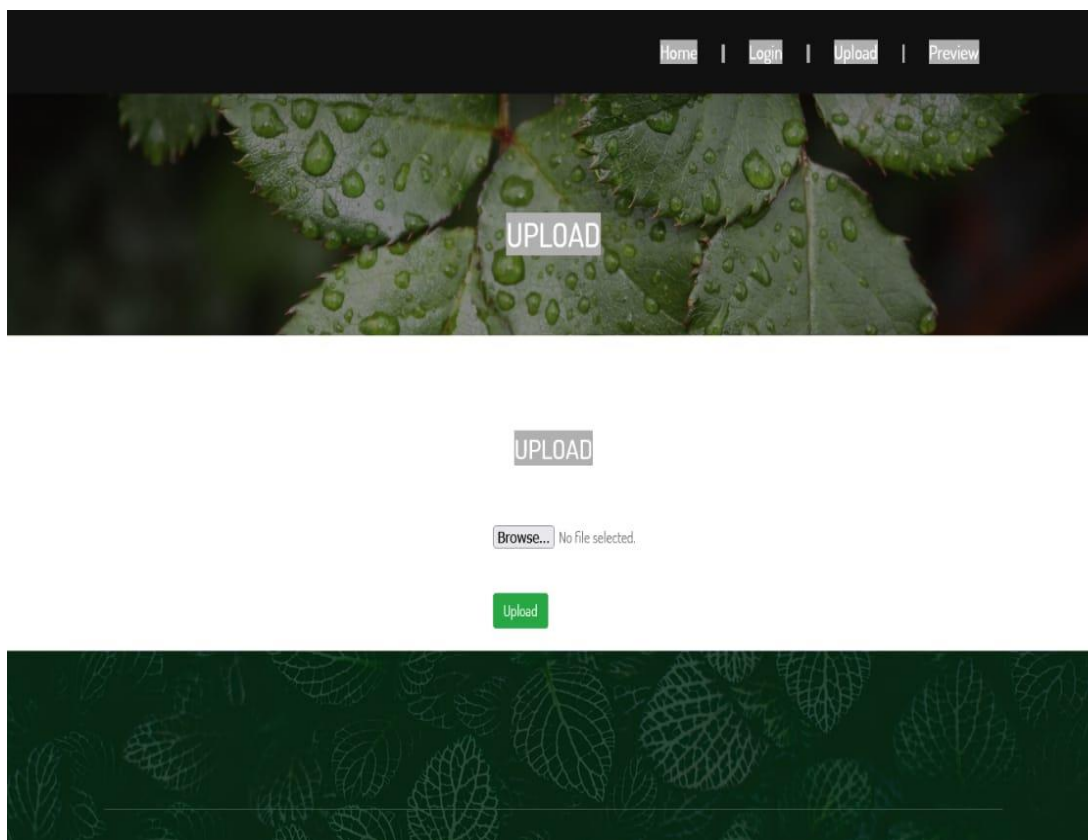


Fig:B.3 upload page

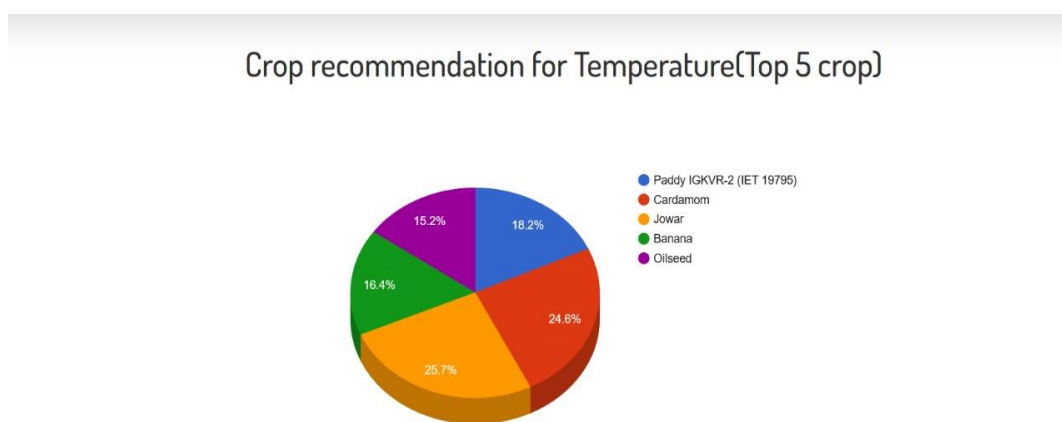


Fig: B.4 prediction for crop

Home

Login

Upload

Preview

Prediction

Analysis

Chart

State:

Andhra Pradesh

Rainfall :

35

Ground Water:

115

Temperature:

40

Soil type :

Black

Season :

Kharif

Predict

Prediction is

Crop: Paddy RC Maniphou 11 (IET 20193) Duration of cultivation: 105-127

Fig: B.5 result for crop recommendation

C.RESEARCH PAPER

AN MACHINE LEARNING BASED ON CROP RECOMMENDATION SYSTEM

K.SRI SAI ROHITH

Department of Computer Science &
Technology
Sathyabama Institute of Science &
Technology
Kotharohith8@gmail.com

K. HEMANTH SAI SATYANARAYANA

Department of Computer Science &
Technology
Sathyabama Institute of Science &
Technology
kodavatihemanthsai26@gmail.com

D. POORNIMA

Assistant Professor,
Department of Computer
& Technology
Sathyabama Institute
poornima.d.cse@sathyabama.ac.in

S.L. JANY SHABU

Associate Professor
Department of Computer
& Technology
Sathyabama Institute
janyshabu.cse@sathyabama.ac.in

Abstract— As the coastal nation of Tamil Nadu faces uncertainty in agriculture, its miles lowering its proportion Construction. The larger the populace and location, the better the productivity. Can be accomplished. In preceding a long time, farmers used to speak, however now it is not possible. Used for heavenly motives. Provide agricultural facts and parameters Notes on agricultural data. Agriculture is changing due to the upward thrust of IT world. Science is right statistics to assist farmers in agriculture. An intelligent utility in the existing scenario there is a want for current technological methods within the agriculture area. The assignment is to use device getting to know strategies to build models with properly defined data. Helps in achieving forecast. Agriculture associated troubles like crop forecasting can be analyzed. Due to variables Environmental climate elements require effective generation Encourage cultivation of crops and help farmers in their production Control this will help in enhancing the agriculture of destiny farmers. A farmer can provide pointers to the organization to assist him grow the crop. Using statistics

mining. Crops recommended for making use of this approach Data analytics paves the way for worthwhile growth Agricultural Database Extraction. Crop recommendations are made based totally on yield and season.

Keywords: - Machine Learning, Crop Analyzer, Agriculture, Fertilizer.

II. Introduction

Indian farming has an extended record. Second place in India right now. In cultivating round sand. Sixteen.6% of Gross domestic product in 2009 and half of general rural ventures alongside wood handling and fishing. Constrained difficult work is the money related commitment of horticulture to India's Gross domestic product. A crucial aspect of agriculture is crop yield. Crop yield depends upon on numerous components which incorporate climate, topography, Institutional and money related region. Trouble for ranchers, vulnerability of planting expense. Wikipedia data: In India, suicide has cost between 1.4% and 1.8%, affecting 100,000 people over the past decade. Farmers are unsure of what to plant and what to avoid planting. Due to the uncertain weather, the best

time and location to begin. Different richness conduct is additionally moderate in light of occasional weather conditions change. Conditions and fundamental substances, including air, water, and soil. The collect here is in every case low. Intelligence hints for peasant systems are the strategy for tackling the issue. According to a crop survey, the availability of yield in the fourth sector is a significant agricultural issue. Each rancher endeavors to perceive the reap. By assessing estimates and deals too thoroughly search if they meet anticipations, the producer can hope to partake in specific plants. Farming explicitly depends upon on environment, nuisances and yield the board. This guarantees that memorable events are pivotal for direction. In the battle towards danger in horticulture. In this article we propose a form that settles those issues. The development of this drive is to offer the ranchers a chance to develop crops and give more prominent meriting harvests to a pick not many people. The proposed model is fundamentally a concentrating roughly zenith. The money related and natural circumstances and advantages are broad, so upgrading the states of rustic ways of life is proper. The proposed model predicts crop yield via perusing brain components: precipitation, temperature, place, season, soil kind, etc. The product also allows you to conclude what sort of compost is utilized over the long haul. It is a cutting-edge device. It is generally urged no longer to forestall at simply get right of section to equipment and expensive upkeep.

III. Related Works.

1. Crop Recommendation System for Precision Agriculture/S. I was embarrassed; E. Ramanujam; R. Harine Rajashri; K. Kavya; D. Krithika; J. Nisha/2017

Crops expected to be safeguarded inside the form are coriander, beats, millet, paddy, gram, groundnut, sugarcane, banana and vegetables. Different soil homes had been thought about to

are expecting crop yield, for example, pH, power, disintegration, penetrability, surface, seepage, soil steadiness and soil conceal. The strategy utilized became troupe, which consolidated the capacities of or additional elite designs for higher delivering. The "Majority Voting Technique" is the name of the grouping method used.

2. Crop Selection System to Maximize Yield Using Machine Learning Techniques / Rakesh Kumar, M.P. Singh, JP. Singh / 2021

Crops are surveyed and indicated in step with the predicted yield survey. This type is executed the use of numerous information mining strategies. This article provides a top level view of various aggregation policies which include K-nearest and Naive Bayes. Using this file, we evaluated the category policies and determined which of them were appropriate for scripting in our design.

3. Crop Proposal Framework for Yield Upgrade Utilizing AI Procedures/Rohit Kumar Rajak, Ankit Pawar, Mithali Bendke, Pooja Shinde, Suresh Rathod, Avinash Devare/2017

The technique is described via realities from soil tests gathered from the homestead, vegetation outfitted by utilizing agronomists, boundaries to be done, and soil really take a look at information from a foreordained lab. Information from the dirt looking at research facility machine is changed to solution. Using a vector device (SVM) and an ANN, it uses the records that have been collected to recommend the version with a majority vote casting method.

4. Agricultural Production System Based on the Internet of Things / Monghoon Lee1, Jeonghwan Hwang, and Hyun Yo (2016)

The most recent system offered a few experimental results that we obtained through SW visualization of agricultural records.

5. Intelligent Agricultural Monitoring and Data Collection System/Darshi Vyas, Amol Borol, Shikha Singh/2018.

This important data can be tracked on the website or on the MAS device. Establishing a huge-scale agricultural subject intelligence gadget primarily based on a small OS and trying out the implementation the use of actual-time and historical information contrast.

IV. Proposed System

Crop productivity is influenced by numerous agricultural factors. The suggested work is predicated on the yield of crops in prior years; farmers may be advised to plant certain crops. These recommendations will enable farmers to determine whether a certain area has produced well in recent years. A number of variables, including water shortages and agricultural diseases, can reduce crop productivity. Farmers may find out which crop is in high demand in the market that year by taking production into consideration. A farmer can decide on agricultural trends for the past few years based on this information. Recommendations to farmers will be made taking into account the crop-production season. Using a Decision Tree Classifier, the project's problem statement aims to suggest crops to farmers. The fundamental procedure for this project is to preprocess the data that has been given to us, after which it is utilised to create the model for the backend and connect it to the user interface (UI) using Flask to display the complete and final product.

V. System Architecture

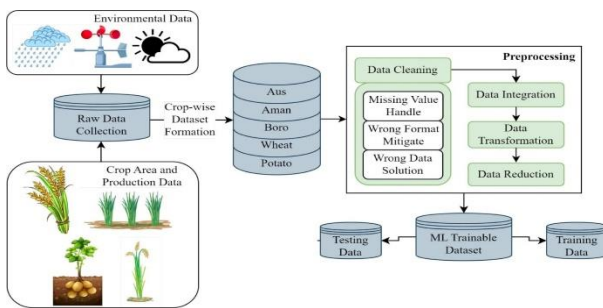


Figure.1 System Architecture

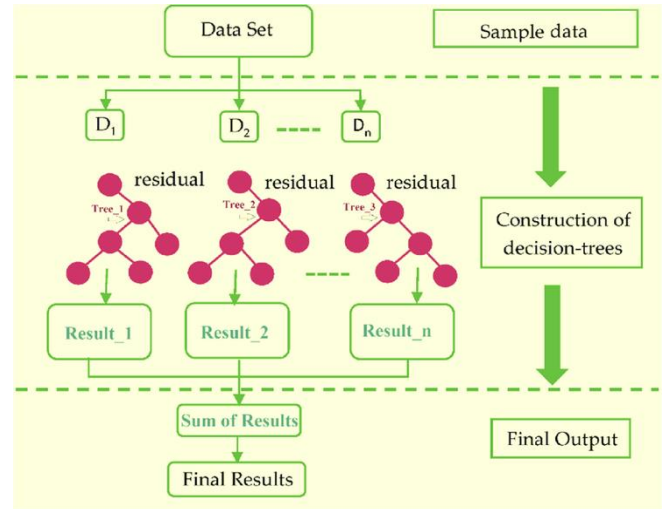


Figure.2 XGBoost Architecture

VI. Methodology

MODULES:

1. Data Collection
2. Dataset
3. Data Preparation
4. Model Selection

1. Data Collection

This is the primary actual step toward real engine development. Study Design, Data Collection. This step is important: the better model, the more facts we get; our model works best. Many post a series of techniques that consist of decreasing textual content; Manual intervention and greater. Records used on this Indian crop advice are from some other U. S.

2. Dataset

The dataset includes 821 man or woman factors. The dataset contains 14 columns that are defined below.

State: Total variety of states in India

Rain falls: Amount of rainfall in mm

Grounded Water: Common floor water degree.

Soil Type: Number of soil sorts

Season: What is the best time to develop?

Crops: Crop sorts

It has to be extra fertile: it wishes specific kinds of fertilizers.

Culture Cost: The general value of way of life.

Expected Revenue Total expected sales.

Number of seeds consistent with hectare:

Number of seeds in step with hectare

Culture duration: Number of days for the subculture length.

Crop Demand: Crop Demand (High, Low)

Crops for mixed sowing: Which crops can be blended for sowing?

3. Data Preparation

Ready to system and prepare records. Clean up what you could. Important (deleting duplicates, correcting errors, managing lacking values; setting, put up kind change and many others.). Statistical randomization lets in you to dispose of the effects of a particular sequence. Other records amassed and/or processed on our behalf. Visualize information to show relationships among related variables. Eminence or Inequality or various exploratory analyses. There is a distinction between coaching and assessment.

4. Model Selection

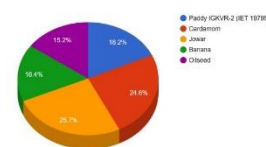
A selection tree is a tree-like, charcoal-like structure wherein a node represents an inner factor (or accurate) and a department represents a diffusion rule; Each leaf represents an output node. The top node of the selection tree is referred to as the foundation node. Learn to split the 2 the use of Returning values splits the tree directly into the recursive section. This lets in you to render a floating view. For those humans, the influence of visualization is that it effortlessly simulates human problems. For this motive, decided on shrubs are marked and effortlessly diagnosed. A decision tree is a white container ML algorithm. Selection shares an internal good judgment that black algorithms do no longer.

Proposed Algorithm:

Decision Tree- Decision trees are computed using supervised studying algorithms.

Selection of wood. Both categorical and regression problems may be used for mastering management techniques. It is specifically used to resolve elegance issues. What characterizes this class are many tree species located within miles. Nodes represent unique statistical characters, branches represent decided on policies, and each node is a leaf. He factors to the challenge. A selection tree has nodes: the choice node and the leaf node. The nights of the court are used to pluck something and feature many branches, and the leaves retreat, and now there aren't any answers outdoor the branches. Conclusions or exams are made handiest on high quality attributes of facts. A graphical illustration is designed to present all viable solutions to a hassle/answer based totally on facts. Conventionally, it's far referred to as a selective tree due to the fact, like a tree, it begins from a root node and expands thereafter. It bureaucracy the branches and shape of the tree. To build the tree, we use the CARD rule set, which represents category and regression.

Crop recommendation for Temperature(Top 5 crop)

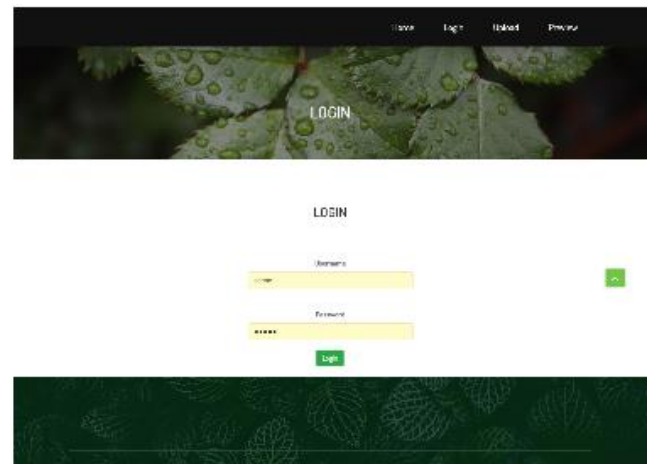
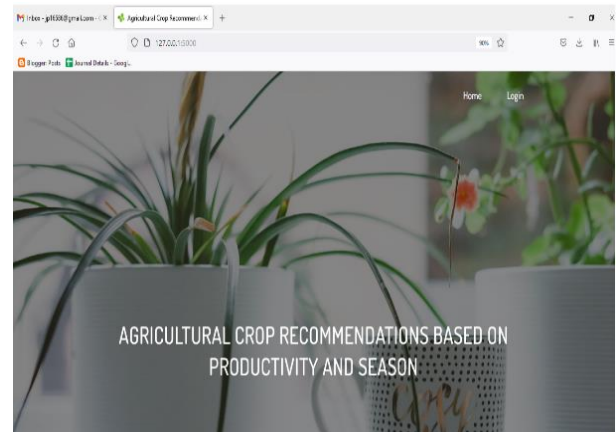


ACCURACY

We got a accuracy of 90.7% on test set by using XGBoost and Random forest algorithm.

VII. Conclusion

Weather estimates vary through area. This need to be a simple mission. Easier to apply than seeps. A mathematical device for environmental evaluation. Weather situations can be decided by means of a selection of schooling strategies, generally simple and permitting on the spot begin and finish. A lot. Its motivation is to cognizance at the useful illustration of the predictive records class, Weather situations in those pics. A prophetic version was additionally created. But its miles organized with sure ethical constraints. Milestones are important to him as they have got the identical competition. Art aims to infer. Then, at this level, pay attention to the suggestions: there are many questions and requirements. Programs will let you achieve aim, statistics about unique elements. It is fairly utilized in areas in which rain is predicted.



References

1. Kevin Tom Thomas, Varsha S, Merin Mary Saji, Lisha Varghese and Er. Jinu Thoma, "Crop Prediction Using Machine Learning", International Journal of Future Generation Communication and Networking, Vol. 13, Issue: 3, pp. 2020
2. J. Meng, "Research on the cost of agricultural products circulation and its control under the new normal economic development." Commercial Times, no. 23, pp. 145147, 2016.
3. Brouwer and M. Heibloem, Irrigation Water Management: Irrigation Water Needs, manual 6 Reading, ITALY: Food and Agriculture Organization of the United Nations.
4. Kiran Shinde, Jerrin Andrei and Amey Oke, "WebBased Recommendation System for Farmers", International Journal on Recent and Innovation Trends in Computing and Communication ISSN: 2321-8169.

5. P. A, S. Chakraborty, A. Kumar and O. R. Pooniwala, "Intelligent Crop Recommendation System using Machine Learning," 5th International Conference on Computing Methodologies and Communication (ICCMC), , pp. 843-848, doi: 10.1109/ICCMC51019.2021.9418375, 2021.
6. S. Jain and D. Ramesh, "Machine Learning convergence for weather based crop selection," IEEE International Students' Conference on Electrical, Electronics and Computer Science (SCEECS), pp. 1-6, doi: 10.1109/SCEECS48394.2020.75, 2020.
7. Suresh, P. Ganesh Kumar and M. Ramalatha, "Prediction of major crop yields of Tamilnadu using K-means and Modified KNN," 3rd International Conference on Communication and Electronics Systems (ICCES), pp. 88-93, doi: 10.1109/CESYS.2018.8723956, 2018.
8. S. Pudumalar, E. Ramanujam, R. H. Rajashree, C. Kavya, T. Kiruthika and J. Nisha, "Crop recommendation system for precision agriculture," Eighth International conference on Advanced Computing (ICoAC), pp. 32-36, doi: 10.1109/ICoAC.2017.7951740, 2017.
9. R. Kumar, M. P. Singh, P. Kumar and J. P. Singh, "Crop Selection Method to maximize crop yield rate using machine learning technique," national Conference on Smart Technologies and Management for Computing, Communication, Controls, Energy and Materials (ICSTM), pp. 138- 145, doi:
10. Raj, Angu & Balashanmugam, Dr.Thiyaneswaran & Jayanthi, J & Yoganathan, N & Srinivasan, PCrop. . Recommendation on Analyzing Soil Using Machine Learning. Turkish Journal of Computer and Mathematics Education (TURCOMAT).
11. ejurkar Siddhi, S., S. Bhosale Meghna, and D. N. Wavhal. "Crop Predication and Diseases Detection Using Machine Learning." (2021)

D. CONFERENCE CERTIFICATE

 **SATHYABAMA**  

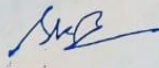
INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)
CATEGORY-1 UNIVERSITY BY UGC
Accredited "A++" Grade by NAAC | I2B Status by UGC | Approved by AICTE

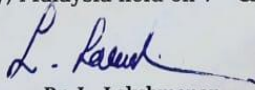
     

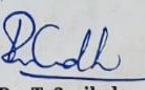
www.sathyabama.ac.in

SCHOOL OF COMPUTING
Department of Computer Science and Engineering

Certificate of Presentation
This is to certify that
K.S.S. ROHITH
of
Sathyabama Institute of Science and Technology
has presented a paper entitled
An Machine Learning based on crop Recommendation System
in the
International Conference on Cognitive Computing and Artificial Intelligence (ICCCAI-2024) in association with
Taylor's University, Malaysia held on 7th & 8th March 2024.


Dr. Sayan Kumar Ray
Head, School of Computer Science
Taylor's University


Dr. L. Lakshmanan
HOD, CSE Dept
Sathyabama Institute of Science and Technology


Dr. T. Sasikala
Dean, SOC
Sathyabama Institute of Science and Technology