A Review of Improve Farming Using Machine Learning Algorithms

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Abstract- *Agriculture plays an important role in Indian economy. But now-a-days, agriculture in India is undergoing a structural change leading to a crisis situation. The only remedy to the crisis is to do all that is possible to make agriculture a profitable enterprise and attract the farmers to continue the crop production activities. As an effort towards this direction, this research paper would help the farmers in making appropriate decisions regarding the cultivations with the help of machine learning. This paper focuses on predicting the appropriate crop based on the climatic situations and the yield of the crop based on the historic data by using supervised machine learning algorithms. In addition, a web application has been developed. The researcher along with these functionalities can access certain datasets that he wants to explore. The researcher can also study the impact of various algorithms on varies data. An add on 'what if' scenario will help not only the farmer but also the researcher to play around with various factors and see the variations in results and proceed with decision making accordingly.*

I. INTRODUCTION

'Smart farming using machine learning and data analytics' is a paper intended studying for betterment of farmers and agriculture in India. Mentioned in the report are the exact goals to be fulfilled by this project – namely, recommendation of the top n crops based on soil properties and environment factors. These take into consideration all the nutrients and micronutrients (around 12 of them) with reference to the soil health card. From these top n crops recommended, the farmer will also be able to know the economically beneficial crop where the model implements price prediction module for the crops. Also, a year round plan will be provided to farmer to maximize his cultivation and earnings through CSM. Besides generic information regarding government schemes or soil testing labs will be provided. The researcher along with these functionalities can access certain datasets that he wants to explore. The researcher can also study the impact of various algorithms on varies data. An add on 'what if' scenario will help not only the farmer but also the researcher to play around with various factors and see the variations in results and proceed with decision making accordingly.

Methodologies of Problem Solving Recognizing the need-

Due to the unpredictable environmental factors or price patterns, farmers are unable to decide which crop to cultivate so as to maximize profit. Even if the crop suits his land a lot of it goes waste if there is no market demand. Thus a model was needed to guide the farmer considering his land and environment and price factors. Collection of information and data: Data required in the project was to train the module for prediction. The data is created by the project members from knowledge set – Various textbooks, Agriculture College Pune's App, Soil Health cards study, etc. Price data was taken from government sites. Creating other alternative solutions: From user's point of view, he has been given the flexibility to choose amongst the various solutions provided by app – single or alternative crop, or a year round plan. From developing point more than 4-5 algorithms have been explored, considered, implemented to provide alternative solutions. Evaluating the consequence of different solutions: User might choose a solution as per his necessity. Algorithms were evaluated for accuracy and mean errors to improve accuracy and reduce errors. Deciding and specifying final best solution: Farmer should go for economically beneficial or year round plan. Algorithm with highest accuracy used for base model. Researcher can refer to data he needs.

Background and Domain–

India being an agro-based country, its economy mainly depends on agriculture produce growth and related agro-industry products. Indian agriculture largely depends on the rainfall which is highly unpredictable. Farming yield is also largely dependent on diverse and multiple soil parameters, like Nitrogen, Phosphorus, Potassium, Crop cycle, Soil moisture, soil pH, temperature and climatic aspects like temperature, rainfall, etc. Nowadays India is very rapidly progressing towards technical innovation and development. Thus, technology will be beneficial as well as blessing to

agriculture which will enhance crop productivity which will result in better yields to the farmer.

Agriculture

Different types of soils have various mineral contents and every crop require Journal of University of Shanghai for Science and Technology ISSN: 1007-6735 Volume 23, Issue 6, June - 2021 Page -984 multiple mineral components for its better growth. Each and every soil has some specific characteristics and is suitable to grow only a particular number of crops. Therefore, an agronomist should be known about the type of soil he has so that he could cultivate better crops. Another important issue that is famers have to face is the uncertainty in the market demand and prices from the time of sow to the time of harvest.

Machine Learning

Machine Learning is a section of Computer Science where new developments evolve at recent times, and also helps in automating the evaluation and processing done by the mankind, thus reducing the burden on the manual human power. It is a type of Artificial Intelligence that provides devices with the ability to learn without being separately programmed. It gives focus on the development of computer programs that can change when exposed to new data. Finding out the suitable crops based on the soil's appearance becomes tedious for novice farmers. There also exists a need to prevent the agricultural decay.

II. LITERATURE SURVEY

Smart Farming using AI and IoT," Nagraj Vallakati,Tomal Ghosh, Shatayu Thakur, Dr. Mansing Rathod."[1] People need to work in agriculture in order to meet their most basic requirements and ensure their continued existence on our planet. Automation (smarter technology) is taking over and improving many fields as technology improves and the Internet of Things is established. Smart homes, waste management, automobiles, industries, agriculture, power grids are just a few examples of the rapidly expanding use of automation in today's world. New technologies, Internet of Things, AI, and machine learning, have helped advance farming. Precision agriculture applications, farm management, and robotic automation will have a significant impact how well things operate. Many physical information can be gathered via sensors and the Internet of Things to aid decision-making, soil and whether or not land is irrigated. To better serve their customers, farmers will be able to predict future crop demand, fertiliser and insecticide that will be needed, and even the weather conditions using artificial intelligence (AI). This will allow us to monitor humidity and water levels maintain the health of our soil thanks to IoT.

Archana Gupta, Dharmil Nagda, Pratiksha Nikhare.," Smart Crop Prediction using IoT and Machine Learning."[2] Agriculture generates a substantial amount of revenue. It is vital for the maintenance of a healthy ecology. Agricultural goods are used in virtually every aspect of human life. Farmers must while also meeting increasing consumer demand for higher-quality produce. To increase agricultural output and growth, farmers must be knowledgeable of their local climatic conditions, which will guide them in selecting the ideal crop to plant. By monitoring the field in real time, IoT-based Smart Farming enhances the overall Agriculture system. It continuously monitors a variety of elements, including humidity, temperature, and soil moisture, and provides a crystal-clear real-time image. In agriculture, machine learning is used to increase agricultural Crop advice can be aided by appropriate algorithms to observed data.

Shardul Pathak1 , Sagar Majgude1 , Sagar Maske1 , Aneesh Sakure1 , Nirmit Singhal1 , Yashwant dongre," Smart Farming using Machine Learning and Data Analytics"[3] 'Smart farming with machine learning and data analytics' is a proof-of-concept (POC) aimed at improving farmers and agriculture in India. The exact goals to be met by this research are mentioned in the report, namely, the recommendation of the top n crops based on soil attributes and environmental conditions. With reference to the soil health card, these take into account all of the minerals and micronutrients (about 12 of them). The farmer will also be able to identify the most economically beneficial crop from the top n crops selected, as the model includes a price prediction module for the crops. A year-round plan will also be offered to farmers in order to enhance their cultivation and earnings through CSM. Aside from general information about government initiatives or soil testing labs, specific information will be provided. Along with these features, the researcher can have access to certain datasets that he wishes to investigate. The researcher can also investigate the effects of various algorithms on diverse data sets. A 'what if' scenario will assist not only the farmer but also the researcher in experimenting with numerous parameters and observing the changes in results before proceeding with decision making.

Fabrizio Balducci, Donato Impedovo , and Giuseppe Pirlo ‡," Machine Learning Applications on Agricultural Datasets for Smart Farm Enhancement"[4] The goal of this project is to show how to manage data and information that comes from real-world datasets that collect physical, biological, and sensory values. As productive businesses, whether public or private, big or small, try to boost

productivity and cut costs, finding ways to use data that is always being collected and made available may be the best way to do this. As time goes on, the "smart farm" concept is becoming more popular because of how it applies the Internet of Things (IoT) paradigm to environmental and historical data through time series. up with and implement real-world tasks, like predicting when crops will be harvested and re-creating sensor data from missing or erroneous sensor data, while using and comparing different machine learning algorithms to help people decide where Innovation is possible while also meeting demands of businesses that want to run a long-term and efficient agriculture industrial business, not only by investing in technology the knowledge and skilled workers needed to make it work at its best.

Divyamary.D,Pradeeba.S," Smart Farming Prediction Using Machine Learning"[5] Agriculture is both a game changer and a key source of revenue in India. Seasons, markets, and biological rhythms all have an impact on agricultural production, yet changes in these patterns cause farmers to lose a large amount of money. These factors can be mitigated by implementing a suitable plan based on knowledge of soil types, pressure, tolerable weather, and crop kind. Weather and crop types, on the other hand, can be anticipated using useable datasets that can help farmers predict which crops to produce. The main focus of this research is on the methodologies used to anticipate agricultural yield and crop cost. All of these elements can be used to achieve smart farming.

III. SOFTWARE REQUIREMENTS

Analysis Models: SDLC

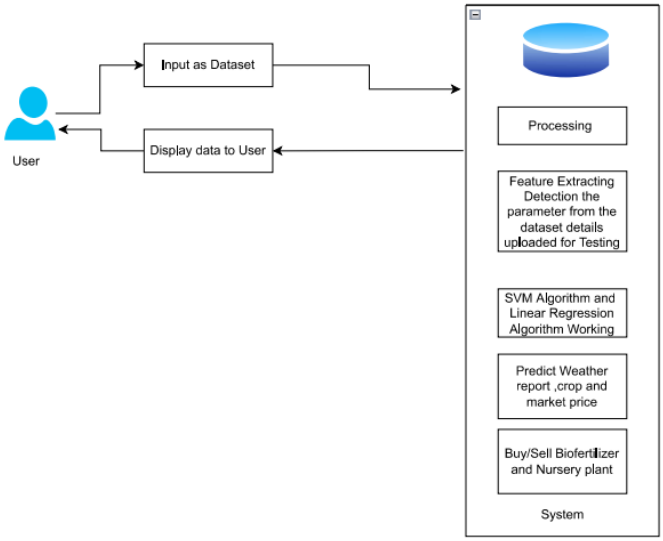
Software development life cycle for the proposed project went through following phases: Requirements Gathering: The requirements for the project started right from the basics to see if the problem is really worth solving. Thus various agriculture colleges were visited to gather the requirements. The requirements mostly included precision in the prediction as, though existing models can be seen, most of them fail to provide accurate results. The data required for the same was gathered in the form of knowledge set through agriculture college textbooks and official app. The technical requirements of platform, technologies, etc. were decided through discussions with the guide. Analysis: The results from the existing models failed due to the uncertainty in environmental conditions and lack of parameters considered for prediction. Thus it was decided to consider parameters that would yield a better result. Dataset was generated from the knowledge set by study and analysis. A lot of papers through literature survey also helped to analyses the gaps that could be worked upon for a better model. Plan and Design: Thus the software design was generated that included the software architecture, all the necessary UML diagrams, and schemas for data and the modules that would be provided through the web app. Key deliverables of the app were decided and usage of algorithms, technologies, platforms, language, database, etc. were also decided. The layout of the app and its interface were proposed. A plan was thus sketched. Build: Actual coding required was done. This included machine learning algorithms execution, front end codes – for static and dynamic web pages, machine learning codes API generation, etc. between devices. It also enables better utilization of the grid by detecting the device's efficiency at a particular time. Remote sensing is one of the Journal of University of Shanghai for Science and Technology ISSN: 1007-6735 Volume 23, Issue 6, June - 2021 Page -985 important wireless measures of Smart Grid Applications. Test: The generated web app was tested and validated for various situational inputs. This included mostly usability testing, security testing, maintainability testing, scalability testing, login testing, database testing, compatibility testing, etc. Deploy: Presently the app is deployed as client server architecture with clients residing in the same network as that of the server. Further deployment on cloud for access over the internet is planned. Maintain: Check for bugs and tackling them is planned when will be needed. The system would be maintained for its availability, security, usability, scalability, and any updates based on users demand would be tried to fulfil.

IV. PROPOSED SYSTEM

We cananticipate the best crop based on soil components in the Soil Health Card and weather reports. I/p - Soil Health Report and I/p - Weather Report O/p - Seasonally Appropriate Crop , Market Price.

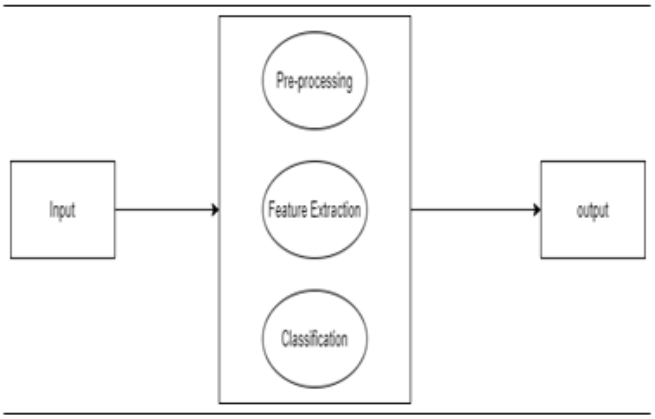
System Design–

System Architecture Diagram Figure –



System Architecture

System Data Flow Diagram



Data Flow Diagram

Datasets

Soil nutrient and climatic factors for crop dataset:

Many researchers nowadays are working on crop recommendation and crop prediction problem despite of that finding data related to this was the biggest hurdle we faced during our project. The major focus of our project was to include climatic conditions as well as all the major soil parameters for crop recommendation because no model yet includes them all together for multiple crops. Hence, no readymade dataset was available to us. We made use of the available knowledge sets to build our final dataset which includes all the necessary soil parameters as well as climatic factors

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	soil_type	Duration	Temp	Rainfall	pH	OrgCarbon	N_int	P2O5_int	K2O_int	S_int	Zn_int	B_int	Fe_int	Mn_int	Cu_int
2	2	130	27	6	6.2	3	3	3	3	1	1	1	1	1	1
3	1	130	26	6	6.2	3	3	3	3	1	1	1	1	1	1
4	3	110	15	2	6.9	3	4	4	3	1	1	2	2	1	2
5	4	95	22	2	5.9	3	4	4	3	1	2	1	1	1	2
6	4	120	27	1	7.7	4	5	4	4	2	1	2	1	1	1
7	4	400	28	3	6.7	3	2	3	5	2	1	1	1	2	1
8	4	100	32	1	6.3	4	4	3	3	1	1	1	1	1	2
9	4	95	25	2	6.2	3	4	4	3	1	1	1	2	1	2
10	4	95	30	2	5.8	3	3	4	3	1	1	1	2	1	2
11															
12															

Crop Dataset

The next important question to discuss is why we have chosen only these particular soil parameters. During our research work in the early phase of our project we came across the concept of soil testing. We came to know that lot of soil testing laboratories have been set up by government as well as by some private institutions which performs the analysis of soil and give details of that analysis in the form of SOIL HEALTH CARD to famers. Figure 5.2 Soil Health Card 5.2 Soil Health Card: It is Indian Government's scheme promoted by the Department of Agriculture and Cooperation under the Ministry of Agriculture and Farmer's welfare. This scheme is being implemented by the Department of Agriculture of all the State and Union Territory Governments. A Soil Health Card gives farmer soil nutrient status of his holding and advices him on the usage of fertilizers and also the needed soil amendments that he should apply to maintain soil health. A printed report of Soil Health Card has the status of soil having 12 parameters, namely N, P, K (Macro-nutrients) Fe, Cu, S, Zn, Mn, Bo (Micronutrients); and EC, pH, OC (Physical parameters). We wanted to include all the major factors that influence the crop suitable for particular soil type hence we had to consider all these 12 factors along with type of soil average rainfall, temperature of that region. 5.3 Market Price Prediction Dataset: For future price prediction, the dataset is collected from agmarknet.nic.in which a government website is providing users with prices of crops. It has district wise price distribution having minimum price, maximum price and modal price. Journal of University of Shanghai for Science and Technology ISSN:

Soil Health Card

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Algorithms:

Machine Learning

Machine Learning is a section of Computer Science where new developments evolve at recent times, and also helps in automation of the evaluation and processing done by the mankind and reduces the burden on the manual human power. It is a type of Artificial Intelligence that provides devices with the ability to learn without being separately programmed. It gives focus on the development of computer programs that can change when exposed to new data. Finding the suitable crops based on the soil's appearance becomes tedious for novice farmers. There also exists a need to prevent the agricultural decay.

V. CONCLUSION

The most important sector for survival has always been agriculture. Our farmersare currently facing numerous challenges as a result of a variety of uncontrollable fac- tors. As a result, as engineers, we must work with farmers to develop a solution for forecasting weather and grain market prices. Our work is a first step in that direc- tion. Prediction can assist us in making strategic agricultural production decisions. We can get weather reports and market prices using machinelearning.

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