Smart Farming Using Machine Learning and IOT

Pawan Kumar and Ashish Kumar

May 1, 2022

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Pawan Kumar
BTech (CSE)
Galgotias University
Greater Noida

Ashish Kumar
BTech (CSE)
Galgotias University
Greater Noida

Abstract : **Agriculture could be a significant source of income. it's necessary for the survival of the environment. People depend on agricultural products in almost every aspect of their lives. Farmers must accommodates temperature change while simultaneously supplying the growing demand for higher-quality food. to spice up agricultural production and growth, farmers must be intimate atmospheric condition, which can help them choose the most effective crop to cultivate under those conditions. IoT-based Smart Farming will help to improve the whole Agriculture system by monitoring the sphere in real time. It keeps variety of variables in restraint, like humidity, temperature, and soil, and delivers a crystal-clear real- time image. Machine Learning is employed within the agriculture business to enhance crop yield and quality. Crop recommendation are often aided by applying appropriate algorithms to sensing data.**

***Keywords*— Agriculture, IoT, Machine Learning, Farmers.**

I. INTRODUCTION

Agriculture is the most necessary part of the Indian economy. 70 percent of the Indian rural families are totally dependent on the Agriculture for their daily living. Agriculture is a significant part of the Indian economy, accounting for over 17% of total GDP. Also 60 percent of our population are employed in Agriculture. From last few decades, Agriculture in India is increasing very fast.

Farmer suicides were attributed to debt, the environment, low produce prices, insufficient irrigation, higher cultivation costs, the employment of chemical fertilisers, and failure, therein order. In most cases, a farmer's decision on which crop to cultivate is influenced by his intuition further as other irrelevant variables like generating quick money, being unaware of market demand, overestimating a soil's ability to sustain a particular crop, and so on. the necessity of the hour is to form a system that may offer Indian farmers with predictive information, allowing them to form better decisions about which crops to provide. This necessitates smart farming, which necessitates the usage of IoT. Agriculture with IoT can be a game changer for humans and therefore the entire planet. Farmers gain valuable insights into the functioning of their crops, greenhouses, and other agricultural activities because of sensor data analytics. Machine Learning- powered farming, with its high-precision algorithms, may be a novel concept that's gaining traction today. This cutting-edge trend, which aims to boost the amount and quality of products, ensures long-term productivity development for everybody involved in agriculture. With this in mind, we have made a model for Smart Management of Crop Cultivation Using IoT and Machine Learning which will help farmers in crop management by taking into account sensed parameters (temperature, humidity) as well as other parameters (soil type, farm location, rainfall) to predict the suitable crop which will give maximum benefit to farmers in that environment.

II. LITERATURE REVIEW

Crop Yields are likely to drop, according to the Climate Change Crop Yield Assumptions study, with the worst losses forecast in some developing nations, including South most Asia (-5 percent) and in India (-5 percent). Infrastructure and marketing issues, improper harvest timing, unanticipated extreme climatic circumstances, and the inability to foresee acceptable crops for farming in such settings may all play a role in the difference in on-farm losses between locations. Here's an example of a comparison:

Rushika Ghadge, Juilee Kulkarni, Pooja More, Sachee Nene, and Priya R L employ Kohonen Self-Organizing Map and Back Propagation Network as unsupervised and supervised learning techniques. Learning networks are used to categorise the data into organic, inorganic, and real estate in order to forecast the kind of soils. It assesses the accuracy of several network learning algorithms and delivers the most appropriate result to the end user. Based on the quality of soil, the system will analyse soil quality and forecast crop yields accordingly, as well as give fertiliser suggestions if necessary.

Reference Paper generates real-time sampling of soil characteristics using MODIFIED SUPPORT VECTOR REGRESSION, a standard Machine Learning approach, and four modules. Among the components are sensor interfaced to IoT device, Agri cloud, real-time sensor data processing, and Agri user interface (AUI). A NodeMCU portable IoT device with soil moisture and pH sensors, as well as ambient sensors, is the first module. Storage is included in the agri cloud module. Using a modified support vector machine method, the real-time data module is processing different types of crops and tiny plants. Agri-user interface is a simple web interface for farmers. Thus, using soil parameters, farmers will be able to determine the sorts of crops and tiny plants that may be cultivated in farms using the Modified support vector machine learning algorithm.

[3] calculates temperature, moisture, and pH value for crop forecast using the ARIMA model. The model takes database values as input and forecasts what a parameter's value will be in one month. The predicted values are then identified using a K mean method based on pH value, yielding k clusters of crops with similar pH values. The top N crops that will be displayed to the user are estimated using the KNN algorithm.

Based on real-time information, the Machine Learning Algorithm (KNN) develops the parameter in [4] to recommend the crop that is best to grow in a given field. To predict the crop, a homogeneous dataset encompassing the bare minimum of crop requirements is stored and used. The sensors are installed in the field, and the readings are calculated there. Data is relayed to the cloud server in real time by the DHT11, MQ2, Soil Moisture Sensor, and Light Intensity Sensor.

[5] evaluates the crop quality factor based on pre-determined meteorological conditions and soil type using the learnt set of data and Supervised and Reinforcement machine learning models. Alternative and preventative measures are performed to safeguard the planted crops and agricultural land if any bad situations are discovered ahead of time. In order to boost total production, specific efforts are made to anticipate the ideal periods for planting, reaping, and harvesting, which may be forecasted as part of the current agricultural revolution.

Citation	**Major Algorithm Implemented**	**Information Conceived**
[1]	Kohonen Self Organizing Map and Back Propagation Network	• The dataset has been trained to categorise it as organic, inorganic, or real estate. • Evaluates the accuracy of various network learning strategies. The most precise result is provided. Predicts agricultural production and fertiliser usage.
[2]	Modified Support Vector Regression	• Using machine learning, analyses real-time data and processes several sorts of crops proposed. • • Using the proposed soil parameters, the farmer will be able to determine the best crop to plant.
[3]	K-nearest neighbors (KNN) algorithm	• A data collection containing a crop's minimal needs is kept. The readings from the sensors are sent to the cloud server in real time. • Based on real-time statistics, recommends the ideal crop to grow in the field.
[4]	ARIMA model	• As input, the model uses values from a database. Predicts what the value (weather) will be in one month to advise a crop.
[5]	Reinforcement models like Markov Decision Process and Q learning	• Various weather conditions need the usage of reinforcement models. • It also predicts the best time to plant.

III. PROPOSED SYSTEM

The technique is designed to assist farmers in making informed decisions on crop forecasting. In addition to current data, historical data for temperature and humidity is obtained and saved from the government website to increase accuracy. Rainfall data from previous years is also collected and stored. To be confident and precise in crop forecasting, the project analyses the temperature and humidity of the field – live data captured using a DHT-22 sensor and historical data taken from government websites and/or Google Weather API –, type of soil – used by the farmer, and past rainfall data. This may be accomplished using either unsupervised or supervised machine learning methods. The dataset is trained using learning networks. The accuracy of several machine learning algorithms is compared in order to produce the most accurate output, which is then presented to the end user. The system not only advises the best crop, but also the best fertiliser for that crop. Farmers connect with the system via a responsive, multilingual website.

Digital Temperature and Humidity Sensor: For monitoring live temperature and humidity, the DHT22 sensor is suggested. This sensor has been demonstrated to be more precise and accurate. It uses a capacitive humidity sensor and a thermistor to monitor the ambient air and sends a digital signal to the Arduino Uno port pin through the data pin. DHT22 has a temperature range of -40 to 80 degrees Celsius and a humidity range of 0 to 100 percent RH.__

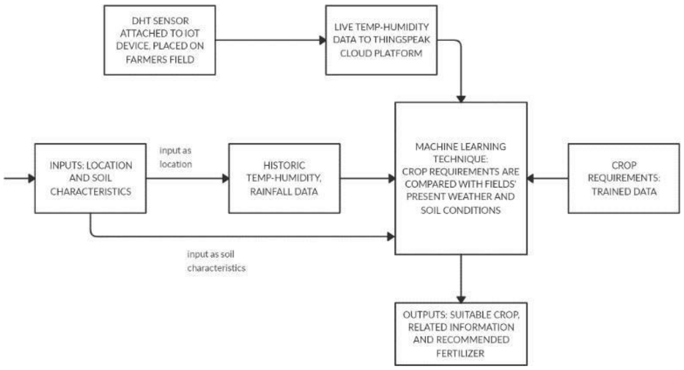

Figure 1. Block Diagram

The functioning of architecture (Figure 1) is following:
Farmer will log on to the website and enters the field's location and the types of soil available for farming as inputs, then after it will be processed.

The field of the farmer will be used as an input to collect historic data from the given location. Weather and temperature data, as well as the quantity of rainfall in the region, are gathered through government websites or third-party apps such as APIs.

The IoT device is deployed on the field to collect real-time data. The Internet of Things device is made up of a DHT 22 temperature and humidity sensor that is linked to an Arduino UNO through an ESP8266 Wi-Fi module. On the Thing Speak Cloud Platform, live data is gathered and stored every hour.

Data is gathered both in real time and in the past. On this acquired data, the VAR (Vector autoregression) model is used to forecast rainfall, temperature, and humidity over a period of time when the farmer is intended to cultivate the crop. Now, the predicted temperature, humidity, and rainfall, as well as the farmer's soil characteristics, are fed into three different machine learning algorithms: Decision Tree, K-NN, and Support Vector Machine, which compare the above results to the predefined data set, i.e. the actual crop requirements stored in the crop data store. Finally, by comparing the accuracy obtained by multiple machine learning algorithms, the most accurate output, i.e. the best appropriate crop, is supplied to the user.

As an output, the farmer receives the most suited produce from the website. In addition, the end user is given all pertinent information about the crop as well as the most appropriate fertiliser.

IV RESULTS

The training dataset includes temperature, humidity, rainfall parameters, and crop pH that are all related to these elements.

temperature	humidity	ph	rainfall	crop
45.6374671	11.19524988	7.341612619	36.522037	5
31.76167796	57.72743864	6.198411713	82.10434989	2
29.17510907	79.21985592	6.658683067	131.0297066	14
24.39736241	79.26861738	7.014063944	164.2697011	8
23.17124551	52.97841162	6.766184468	153.1201644	9
23.89271875	61.78779413	6.658605362	52.55730112	7
29.70143197	95.65754365	6.078807239	215.1968037	16
24.388717	62.50453062	6.711341147	47.26052494	7
24.32719167	55.84027641	4.956920312	202.281286	4
20.27514686	23.2353604	5.877347515	139.7521543	15

Figure 2. Training set

The accuracy percentage of different types of Machine Learning Algorithm- Decision Tree and Support Vector Machine (SVM) is compared. The Decision Tree which is used to anticipate the harvest at the end is most accurate of all.

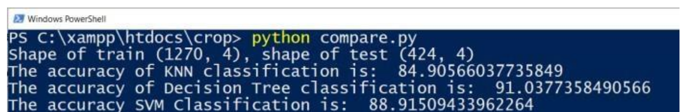

Figure 3. Comparison of the accuracy of the three algorithms

Decision Tree is used to predict the crop, as it has the best accuracy.

The farmer enters the soil pH, location, and projected month to start farming on the "Smart Crop Prediction" website.

Figure 4. GUI of Smart Crop Prediction Website

He does so by registering and then logging in to enter setting.

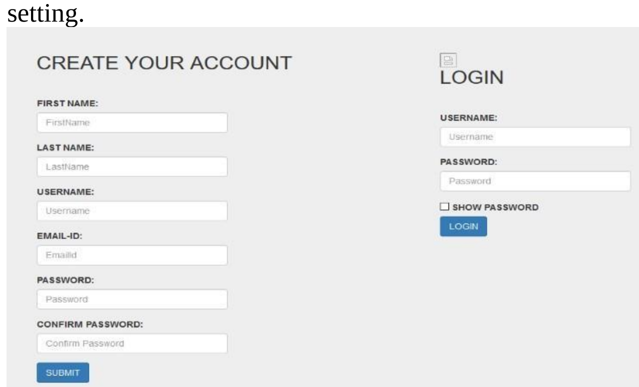

Figure 5. Register and Login page

The appropriate historic and live data is obtained according to the specifications, and the Decision Tree method is applied to it..

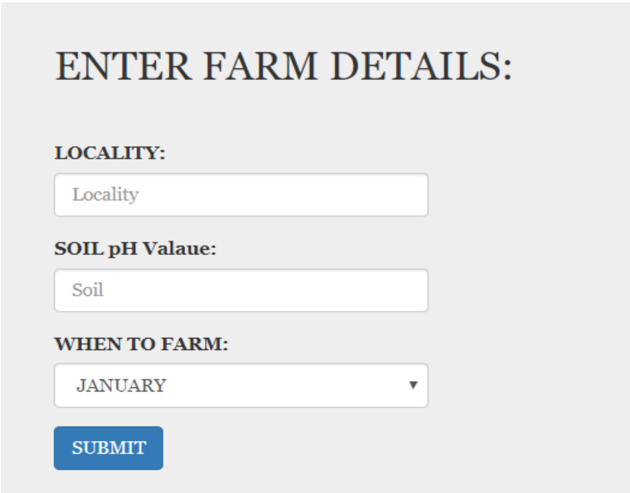

Figure 6. When the farmer logs in, he is led to this page. When you click Submit, the appropriate crop appears on the screen.

Figure 7. Suitable crop as displayed

The farmer may switch to any language using Google language translator, and the webpage will be translated into that language.

V.CONCLUSION

We proposed a revolutionary Smart Agriculture approach based on two developing technique : The Internet Of Things and Machine Learning. In this paper the accuracy of result is improved by both real time data and historical data. The accuracy of the System is also improved by comparing g various Machine Learning techniques. This strategy will assist farmers in overcoming hurdles

VI. FUTURE SCOPE

The system can also be improved further by including these features: Use of soil moisture sensors, environment sensors, and pH sensors to improve crop prediction accuracy. While recommending a crop, consider the location's market requirements as well as the crop of nearby farmers.

VII .REFRENCES

1. AI Edge and IOT - based Smart Agriculture 1st edition Nov 2021 by Sujata Das, Joel J.P.C Rodriguis, Ajith Abraham, Biswaranjan Acharya, Subhedu Kumar Pani

2. Agriculture 5.0 (AI, IOT and Machine Learning. By Latief Ahmed and Firasath nabi.