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Implementation of Smart Farming using ML and IoT

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Abstract

The Main Aim of this project is to boost the potency of the Agriculture sector. Different weather parameters area unit taken into thought with that the simplest appropriate crop to be fully grown area unit foreseen with the assistance of supervised learning like call Tree Classifier, Regression, SVM. Facilitate of various sensors, the soil and part conditions area unit determined and transferred to machine learning algorithmic program and analysis present itself. The only answer to {the current} downside is sensible agriculture by modernizing the current ancient strategies of agriculture. Hence the project aims at creating fashionable agriculture victimization automation and IoT technologies victimization raspberry pi and machine learning. With the assistance of IoT alongside Machine Learning within the field of agriculture. Will area unit able to increase the yield of the crops and during this system even we tend to are intimating the farmer regarding natural disasters so he can take safety preventative measures. . The result of crop prediction is given through a mobile app and the intimation of natural disaster is given through normal sms so it would be user friendly.

Keywords: *SVM, Regression, Decision tree classifier, Raspberry pi, Sensor, Android app.*

1. Introduction

Agriculture is the backbone of India and almost 70% of income for our country comes from Agriculture. Now farmers are facing issues in yield of the crop and to many farmers are committing suicide so to solve this problem of farmers we have come to a solution for the problem that is smartagriculture.

Smart farming is a new idea in agriculture as the Program of agricultural management identifies, analyzes and handles the variation of fields in order to ensure events, properties and security of the environment, victimizing data technology. This can be one in each of such initiatives that utterly concentrates on creating the farming technique additional inexperienced and proper by analyzing the various conditions of a farmland.

There's no guarantee of crops health and farmers will create profit out of it. New information technologies are often used to creating higher selections on several aspects of crop production in sensitiveagriculture.

(i) It is evident that precise agriculture enhances the effectiveness of recognizing and resolving a field's natural variability. The rule provides farmers with guidelines about what needs to be done in order to avoid the infection as quickly as possible through the information gathered on the climatological and terrestrial conditions of the plants through victimization.

(ii) The key incentive is to produce these farmers using an Automation System which tries to solve all of the problems that have been expressed in addition to reduces value, human power andtime.

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(iii) Additionally, IoT is used to collect sensors from the field so that the information, and thus the cc rule recommendation, is always accessible on a platform interface, which facilitates continuous observation of the sphere. The IoT devices program implementation provides an automated response to the prediction ofinformation.
(iv) The results would allow the farmer to call correctly with the related results. The system can provide all previous information ahead to the farmer for taking correct call .The device designed would boost disease detections and predict but the epidemic can grow in the field ofcrops.

2. Related Work

The system which we have provided for the farmers for the prediction of yield of crops through Machine learning and Iot will be of great use for the farmers. In previous years, lot of studies and research has been done.

According to Alaa Adel Araby, The cloud is the source and destination for information that adds insight through the code for data processing,. Sensitive farming uses IoT tools to help control crops, maximize the crop level through the application of required nutrients and raising the effects that excess pesticides have on the atmosphere. In this paper, the sensing network was deployed to compile information on the area of some crops so that the information was fed into a machine learning rule so that the alarm message was finally displayed, each with the data and alert message through the graphics software (GUI).[1]

According to D.K. Sreekantha Desai, IOT helps farmers from anywhere and anywhere to induce related farmers. Wireless network detective unit used for farm conditions monitoring Small-scale managers in Nursing area unit have accustomed control and easily automate farm processes. Wireless cameras are used for remote reading of picture and video conditions. A responsive phone enables farmer to remain up-to-date at all times and in every part of the globe on a continuing condition of his farmland victimization IOT. IOT technology will reduce prices and improve old-farm productivity [2].

According to in keeping with, Ivan Špeh, Ivan Heđi There is a planned web-based IOT resolution. IoT technologies for spatial victimization are the object of that resolution to enable detection of various development techniques. Victimization of this form of protocol is avoided, as a consequence of the affected rural area networks. Displaying and maintaining data gathered from sensors in a portion of the data network. This concept is based on the potential concrete implementation in several agricultural sectors at a minimum[3].

According to FuBin This system includes three platforms. In order to obtain the details of the that melon, the trained system service platform found the mathematical model to make a decision. The smart development platform will handle the plant's climate, water supply and chemistry. Associate in Nursing extended service for fruits growers and shoppers is a online mercantilism site with traceability running. It is important that an intelligent agricultural system is built to manage and optimize fruit planting management of the crop growth atmosphere, and so on. It will give fruit growers advantages if the device is used in a very huge area. [4]

Ling-ling Li, the Shi-feng theory, Li-yan Wang, Xiang Ming authority explains ZigBee-assisted greenhouse observation, briefing on the requirements and equipment, and on the network manager node and on the detector node. This paper discusses the characteristics of these 2 systems. The experiment shows that in traditional conditions of communication the node and the network organizer area unit, network stability is Good, the information suitstheessential environment, and wireless-detector networks are therefore able to respond to the needs of applications. [5]

3. Objectives

The main objective of the project is to implement current modern technologies for smart agriculture in the field of communication and networking.
(i) To learn the details of Iot devices and machine learning algorithm.
(ii) In Iot part there are four main functional they are Collecting (sensors and controller) => Communicating (wifi module or any communicating media) =>Analysing (checking for the threshold)=>Acting(actuators like pump and fan controlling).
(iii) In machine learning the previous data for building machine learning models, that data we are getting through the iot.
(iv) In machine learning we are using SVM algorithm that is Support Vector Machinealgorithm.

These are the main major functions used in our projects which is more helpful for the farmers to get more yield.

4. Problem Statement

Farmers in Republic of India tend to adopt their relative's standard technology. The problem, however, is that anything happening on time was horribly unsafe at the earliest moment. Yet most of the things are actually updated due to global warming and several other factors. In the Republic of India the most downside of agriculture is a seasonal lack ofirrigation.
(i) Moisture is also important for crops but it was too heavy, it also becomes a drawback. Therefore Rabi cultures are widely affected in the winter season. The winter rain has clearly been high for a few years.
(ii) We want to create a program that is capable of understanding the occult truth, outcomes, patterns and

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wisdom to solve them better than problems. The farmer forecasts the crop should be planted so that he gets a lot of income. In the scheduled method we prefer to apply techniques for information analysis to farming based on data and make the decisions simpler for thefarmers.

(iii) For this analysis, a method based on descriptive analysis is tangentially developed. This will help farmers understand what happened in diversion and what is to be done. We therefore aim here to collect and prepare several data sets of several of the know- how from agricultural development, rain andsoilinformation.

(iv) Through this way we continue to learn to train the model by being mistreated and to provide the calculable value of output of crops and of different categories ofoutput.

5. Methodology

This mission includes plan of crops that may be best appropriate for cultivation in an exceedingly selected farmland once the consideration of the climate and environmental condition things of that geo-location. totally different supervised machine learning methodologies inherit play for the on top of prediction. The non-stop watching of the soil things at some purpose of the whole increase of the crops. These carries with it soil parameters like temperature and wetness, soil wet content, soil water level, etc.. The farmer will access the server regarding the sector condition anytime, anyplace thereby reducing the person power and time.

The project uses Raspberry Pi with multiple detectors connected thereto like Soil wet sensor, water level management detector, wetness detector etc that takes readings of the encompassing surroundings on a periodic basis. The mission of the project is to intimate the farmers or alternative stakeholders in predicting crop-failure. this is often accomplished by a Machine Learning Layer that has been modelled to spot the degradation of a crop's health before its degradation starts. It uses SVM-algorithm to cluster the crops consistent with the obstructive contingency .The next iteration identifies the foremost evidence and thru a UI intimates the neutral what steps must be taken to stop crop-failure.

The whole method is split into 2 parts:

Training Phase: Initially the sensing network circuit collects knowledge from the surroundings and undergoes pre- processing. The Clean information in this way got is taken care of onto the Machine Learning Classifier that is responsible to isolate the data and arrange them into classifications of Dry, Excess Heat, Healthy or Unfavorable. at present these capacity the thought for characterizing obscure information infuture.

Testing Phase: because the name suggests, this part is liable for testing unknown knowledge gathered at real time exploitation the machine learning classifier that's already enforced. The Classifier segregates the info by evaluating the constant options and assigns it a category which can be Dry, Excess Heat, Healthy or unfavourable.

The system majorly consist of two modules:

i. HardwareModule
ii. Softwaremodule

i. Hardware Module:-

1. Raspberry pi 3:- - The Raspberry Pi may also be a handset, mastercard, that connects to a portable or televised monitor and uses a typical mouse and keyboard. It to boot has really low power consumption between zero.5W and 1W.New Out Of Box code (NOOBS) offers the user a variety of package from the standard distributions. Raspbian is that the recommended package for ancient use on a RaspberryPi.

2. Temperature and humidity module:- DHT11 may also be a compost detector, which would include a digital temperature and humidity signal output tag. The use of obsessive automated modules and the temperature and humidity sensor systems to ensure the product is consistent and has excellent long stability. The detector has a wet sensing connected to a superior 8-bit microcontroller and has an integrated NTC temperature activationunit.

3. MCP 3008 :-In addition, an 8-channel 10-bit digital analog converter may occasionally be worth the MCP3008.. The preciseness of this ADC is associate logos there to of associate Arduino Uno, and with eight channels you may scan quite few analog signals from the Pi. This chip could also be a pleasant alternative if you merely need to be compelled to scan easy analog signals, like from a temperature or lightweightdetector.

4. Water level management sensor:- Specific level sensors square measurement normally used to assess if the fluid is less than or reaches a maximum level. There was a mistake. Many forms use a magnetic float, which rises and falls inside the instrumentation with the air. After the liquid reaches a certain point, the magnet is activated, byextension.

5. Cloud:-ThingSpeak is a Partner PC software web application for Things (IoT) and API to store, and collect data from objects that violate the Convention on MQTT across the network or through a territorial zone network, in compliance with its designers. The ThingSpeak helps you to make applications for indicators, to follow applications and to coordinate things interpersonally with notifications.

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6. Block Diagram

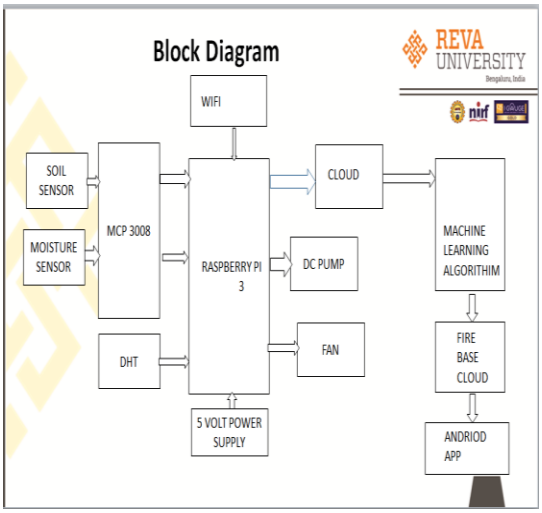

Figure 1: Block Diagram

Algorithm:-

AI (regulated learning) technique is the support vector machine. This is non-linear in nature and is used for both characterization and recurrence. Other nonlinear strategies such as falsified neural networks, truck, and so on are available. Direct order is some way or another simple to actualize as contrast with nonlinear characterization. Since in straight method we can discover choice limit and bolster vectors without any problem. The straight line of preference and bolster vectors are elusive in the nonlinear way. We use the hyperplanes to deal with thisproblem.

A hyperplane in the N dimension space(N — the quantity of highlights) is discovered in the aid of the vector machine calculation which groups information in particular.

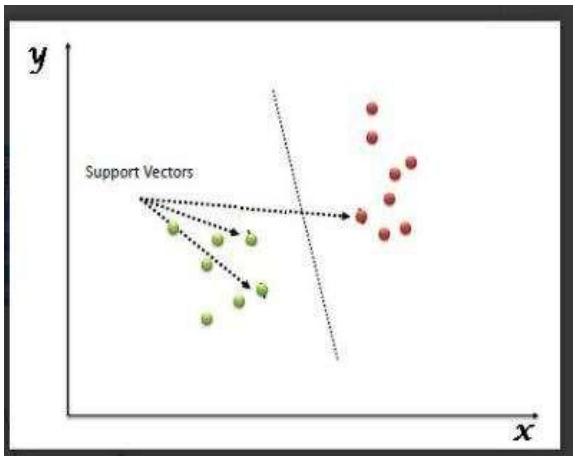

Figure 2: Example of Support Vectors

$y = w0 + w1x1 + w2x2 + w3x3$ (1)

There is the yield, XI displays characteristic figures, and wi, there are four tasks to understand in inclination. In (1), loads for the hyperplane to be chosen. Bolster vectors can describe the largest edge hyperplane as follows:

y = b + aivixi .e (2)

When vi means a class gain for the x(i),•(dot)speck element between information (x) and any vector of support x(i). (speck element). The vector x is a test model and the x(i) vectors indicate the vectors of aid. From the preparation information, the coefficients b and αi (for each information) should be calculated. Right now, the hyperplane referred to b and αi Identify bolster vectors and parameters b and αi, which are typical of strictly restricted quadratic programming (QP) with the ultimate objective.

As stated, by changing information factors into high dimension element space, SVM allows a direct model for the use of non-linear class limit. In the case of nonlinear detachable, a high-dimensional (2) version is essentially depicted as follows:

$y = b + \alpha iviK,\mathbf{x}$ (3)

The K(x(i),x) functionality reveals the piece function(KF) here. This KF is like ANN's learning ability.

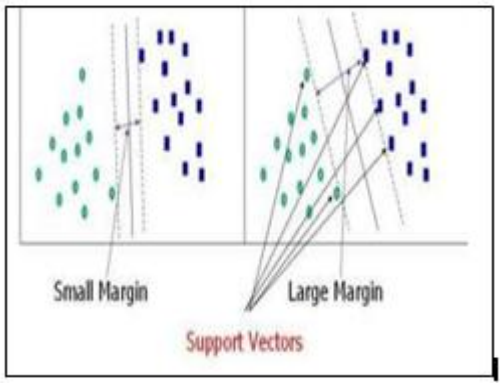

Figure 3: Support Vectors

(i) This SVM supports the algorithm of a vector machine to predict cropyield.
(ii) Compared to other algorithms SVM gives more accuracy so this algorithm is mainly used in oursystem
(iii)This SVM algorithm can be used for both small as well as large data sets.

ii. Software Module:-

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This software module includes 2 parts:- 1.Machine learning module
2. Mobile app

1. Machine Learning Module:-

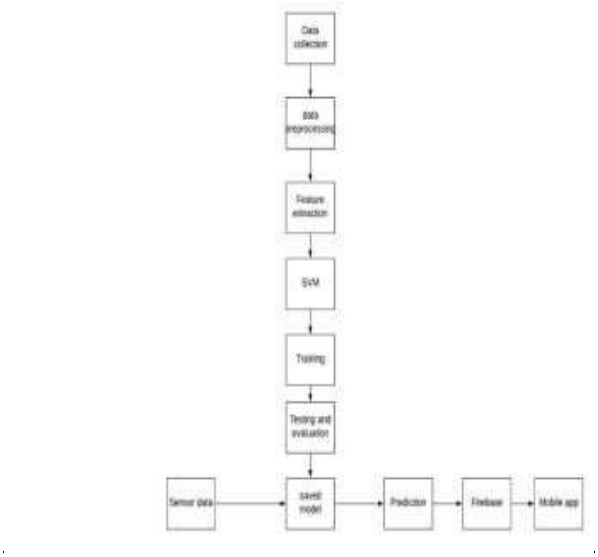

Figure 4: Software block diagram

i. Data collection: The analysis of information ensures that the processing and evaluation process of data on selected variables in a longer-term program allows you to answer relevant questions and analyzeoutcomes.
ii. Data pre-processing:-The raw data information collected from the information assortment is pre-processed and clean data is fed to the feature extraction. during this method the data is clean and remodeled for moremethod.
iii. Feature extraction:- Feature extraction may be a method of spatial property reduction by that Associate in Nursing initial set of data is reduced to additional manageable teams for process. A characteristic of those massive knowledge sets may be a sizable amount of variables that need a great deal of computing resources tomethod.
iv. SVM algorithm:- "Support Vector Machine" can be a controlled machine learning rule that can be used for any challenge of classification or regression. SVM can be a major classifier, defined in uninflected hyperplane nursing associate. A line that breaks down a plane into 2 components in two dimensions — a hyperplane comprises one aspect group. Nonlinear category boundaries are created by SVMs. They primarily develop a more sophisticated linear classification called a hyperplane. SVM is building a hyperplane in an infinite dimensional house. SVD is thus the technique called the utmost marginal hyperplane, which can be an explicit linear model. This hyperplane helps increase the margin between the categories chosen (a margin will distinguish the line from the nearest points). The vectors (cases)that
characterize the hyperplane are vectors / data points / training abilities. In the other training examples the binary type bounds are not clearlyillustrated.
v. Training:- during this part the model is trained with the information and therefore the machine learning SVM rule and so it's given for more processes forpredicting.
vi. Saved model:- this is often the model that is saved when coaching with knowledge and so even the device knowledge is fed into the saved model for the long run prediction and so it's foretold and therefore the foretold.
vii. Firebase:- the predicted the Associate in the expected knowledge is then hold on within the fireplace base and therefore the results are given through an humanoid app.

2. MobileApp

This is Associate in Nursing computer program for the farmers a mobile app. This app is formed victimisation university app discoverer for a straightforward understanding of the prediction of crops and giving the tip results through this mobileapp.

7. Results and Discussions

Farming is automated everyday by simplifying farmers 'work and maximizing crop production. In agriculture the IoT method is basic, and can be carried out on an ordinary basis that is useful in predicting ecological factors through records of the soil, wet level and temperature monitoring. In this scenario too, the Mari culture can be strengthened. IoT will increase the efficiency of a output along with cloud.

The use of this device becomes extremely conserved as the water scarcity is greater. The research can be expanded further from the above data gathered from variousstudies.
(i) Few requirements with accuracy, flexibility and the programming languages of open source that include and python are used as a program can be advanced. In addition to citrus plants and efficiency testing, the production of the clever Irrigation Machine can be carried out in other plantations. The information set can however be improved to increase the device's accuracy Furthermore, the sophistication of the protocol is minimized by the authentication scheme with compromising safety features. All the paintings can also be paired with cloud computing. A number of new decisions can be made on plants from the previouspaintings.
(ii) In farming, there are sensors that can do wonderful things. There is no top agriculture in the world, but it can be made clever. The data set is preserved and used for additional reference for each clever painting inagriculture.

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(iii) The proposed system has many advantages compared to other systems. This system will predict the accuracy of the crop prediction is more .The data set which is obtained from
the sensors will be fed as input to the machine learning algorithm and can also be stored for future use or future projects.

8. Conclusion and FutureScope

(i) In order to meet the demand for developing meals for the increasing global population in view of the ever-shrinking arable land, the emphasis is on smarter, better and extra productive crop production methodologies. Today we can easily see the emergence of the new techniques to boost crop yield and handling: young, innovative, younger people taking on agriculture as a trade, agriculture as a means of independence from fossil fuels and tracking crop production, safety and nutrition labeling. This paper considers all these aspects and emphasizes the role of various technologies, in particular IoT, in order to enhance the knowledge and productivity of agriculture in the future. Wifi sensors, UAVs, cloud computing, communications technologies are thoroughly discussed for this purpose. In addition, a deeper insight is provided into the recent research efforts. Additionally, numerous IoT-based architectures and systems are supported for applications in agriculture. To give researchers and engineers guidance, a review of the current problems facing the industry and future expectations is described. On the basis of all this, every inch of land is important for optimizing crop production. Nonetheless, the use of sustainable IoT sensors mainly based on technology and communication are not sufficient to deal with any inch accordingly. In this way, the project strives to bring efficiency and accuracy inside the area of agriculture via automating the entire agricultural method with the assist of Internet of Things and MachineLearning.

(ii) This acts as a complete bundle that each farmer could preference to possess. This mission is completely oriented within the route of the farmer welfare and agricultural development. It aids the farmers with the whole manner of farming from the start till end. With taking desirable care of these crops, it allows the farmers to pop out in their poverty via imparting with a proper amount of yield at theend.

(iii) Since this undertaking is additionally cost effective and affordable with the aid of maximum of the farmers in India, there may additionally be no question that this venture would be a marketplacehit.

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