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AI Based Crop Monitoring Using IOT

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***Abstract:** An amalgamation of agriculture and technology is a pressing need of the 21st century. Most local farmers in the state of Maharashtra are not yet privy to advanced methods which can yield much better produce. This study focuses on cumulation of diverse agricultural components like the crops, plant fitness, climatic elements, hazards, and irrigation. There are so many determinants in the field, we have used of Internet of Things, Wireless Sensor Networks and Machine Learning(ML) algorithm technologies. Through IOT and WSN, we have used sensors for collecting plant information further utilized for tracking and predicting crop and weather parameters. Weather forecasting and the potato plant (disease) identification are done via Con- volutional Neural Networks with the assistance of datasets. The results obtained include identifying if Blight disease occurs on the potato plant, automatic irrigation when soil moisture level drops, remote crop monitoring, weather forecasting, etc .The notion is to help people in the farming industry to boost their methods and provide modern cultivation strategies which are not expensive, tedious and inconsistent.*

***Index Terms:** Iot, web app, cloud storage, Ml Algorithm, smart farming, weather data and weather forecast.*

I. INTRODUCTION

Agriculture has visible many revolutions, whether or not the systematic use of crop rotations and different upgrades in farm- ing exercise some hundred years ago, or the “inexperienced revolution” with breeding and the use of synthetic fertilizers and insecticides from some decades ago. But now, agriculture is in the fourth revolution induced with the exponentially growing use of the latest tools. Technology-based agriculture is replacing manual agricultural methods with each passing day. In developing nations like India, making farmers aware and helping them gain access to these technologies is of utmost importance. The ingenious methods still practiced here are pre-venting the farmers from making profits despite huge efforts.

[1] With our device, we have made an attempt to cut back the tremendous labor and uncertainty that comes with farming. Unmanned tracking of crops and automated manipulation of

Identify applicable funding agency here. If none, delete this pumps lays the base for uncomplicating farm management.[2] Precise agricultural structures lessen ecological footprint in addition to sources ensuing in hard work and different costs. [3].

Our IoT system is primarily based on smart irrigation which mechanically sprinkles water when the moisture level drops below the threshold value. It also sends the soil data statistics to the cloud to evaluate land condition. [4]. We predicted actual weather conditions which will be prevailing in the coming days and accordingly inform the end-user to take measures in order to save and plan the resources for the effective growth of crops. [5]

The system provides weather prediction records, Crop Dis- ease identification, Crop Recommendation based on the soil quality and an internet app to assist farmers with. Cloud storage is used to screen crop statistics. It is utilized as a provider for supporting monitor statistics remotely. [6]

A. Problem Statement

In traditional farming, cultivation is a manual process, where irrigational needs of a crop and its yield is depends on weather factors. As of 2018, the agricultural sector which employs more than 50 percent of the total workforce in India ; contributed around 17-18 percent of the country’s GDP. There is a growing demand for gadgets that automate the age-old prac tices of cultivation, irrigation, prediction of yields and allowing in higher call for and delivery of agricultural produce. India is yet to level with the advance farming methods of the West.

Modern cost-effective technologies made available on a mass scale can reduce this disparity. The need for smart agriculture amplifies sustainability in terms of productivity, incomes, adapting and constructing resilience to numerous environmental factors. Hence, in our mission to improve the current agricultural process of our state, we have been able to work on Weather prediction (Monitoring seasonal changes), Potato plant disease identification, fitness monitoring, Fertilizer and crop recommendation along with Smart irrigation for productive cultivation and limit related losses.

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II. RELATED WORK

Zohaib Amjad, Jahan Zaib Tariq , Ammerha Naz.[1] The Proposed Recommender System receives real-time values through sensors implanted in consumer farms to make guidelines approximately appropriate plants to grow, fertilizers, pesticides, and irrigations to position guidelines. Microcontroller grabs information from sensors and transmits to the webserver (fog nodes) wherein rule base evaluationwill carry out to fit among predefined situations and the current state of plants grabbed via sensors.

Basudeba Behra , Samita Kumari, Alisha Kumari, Ajay Kumar [2] The proposed system uses technology together with Wireless Sensor Networks (WSN) and Internet of Things (IoT) for fixing the primary issue confronted in agricultural fields. The received records approximately numerous parameters canbe despatched over to the cloud platform in which it is goingto be analyzed and processed in opposition to the specified climatic situations and the similarly processed records maybe used for climate prediction the use of Machine Learning (ML) and Application Programming Interfaces(APIs) and similarly, the farmers may be knowledgeable approximately the identical to be able to goal for accelerated agricultural productivity.

Kiranmai Pernapati [3] In this paper Smart Irrigation System, One of the important and simple offerings to continue to exist in the world is Water. In recent times growing, the shortage of water growing because of the growthin population. So that is turning into a well-known obstacle. The antique irrigation gadget needs a variety of water, so it wishes smart strategies for decreasing the proportion oflosing to be had water for the irrigation.

Kavitha B C, Shilpa D P, Thanushree K S, Swathi A M, Ranjitha M K [4] In this paper The Internet of things(IoT) is transforming agriculture allowing the farmers withan extensive variety of techniques. IoT technology enablesin gathering data about situations like weather, moisture, temperature, and fertility of the soil, Crop online trackingallows detection of weed, level of water, pest detection, animal intrusion in to the field, crop growth, agriculture.

G. Prem Rishi Kranth M. Hema Lalitha Laharika Basava Anjali Mathur [5] The seen capabilities along with shape,size, dryness, wilting, are very useful to understand the plant condition. The studies paper offers all such functions andfollows various machine learning techniques to discover the output. The studies work offers a decision tree, Naive Bayes theorem, Convolutional Neural Network, and k-mean clustering and random forest algorithms. Disease improvement relies upon 3 situations-host plants susceptible to sickness, favorable environment, and feasible pathogen. The presence of all 3 situations needs for a disease to occur Sharada P. Mohanty David P. Hughes Marcel Salathe´[6] In this paper the author has used Deep Learning for Image-Based Plant Disease Detection. The combination of developing global smartphone penetration and modern advances in computer vision made possible via deep learning has paved the manner for smartphone-assisted sicknessdiagnosis. Using a public dataset of pics of diseased and healthy plant leaves accrued beneath neath controlled conditions, we train a dataset (a deep CNN to discover 14crop species and 26 diseases)

III. PROPOSED SYSTEM ARCHITECTURE

In our system architecture, we have used Node MCU ESP8266 as a microcontroller to control the system and sensors such as DHT 11, soil moisture to evaluate soil parameters. We have used Thinkspeak as the IoT cloud platform for the data obtained by the sensors. NodeMCU circuit code is executed on Thingspeak to establish connectionbetween iot data and cloud using an api key. We have used an appropriate dataset for predicting the weather by ML using Random Forest algorithm. For the irrigation system, we have utilized a DC motor for pumping water as per the plant requirement. A solenoid valve is connected to the relay module, so whenever NodeMCU generates a trigger it sprinkles water. Relay Module works as an electrically operated switch. Current flowing through the coil of the relay creates a magnetic field that attracts the lever and changes switch contacts. A 10k variable resistance potentiometer is used as a resistor for the current flow. A dataset of the potato plant crop images is used to perform disease identification using Convolutional Neural Networks algorithm. We haveused a dataset for predicting the Crop Recommendation forthe type of crops to be cultivated best suited for the respective conditions. The Fertilizer Recommendation recommends the type of fertilizer appropriate for the particular soil and the recommended crop.

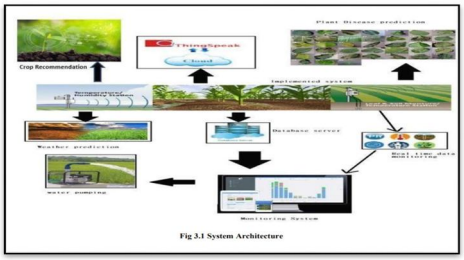


Fig. 1. System Design

IV. TECHNOLOGY USED

A. *IoT*

IoT has played a vital role for the Crop Monitoring module. Major part of the module is IoT. We have used several sensors for monitoring the properties of the soil and valve and motor for the irrigation purpose. Data received from the sensors is sent to Thingspeak which is an IoT cloud platform wherein you can transfer statistics to the cloud.

B. *Machine learning*

ML Algorithm: Since in the proposed model, further than one class can be assigned to a single case, Multi-label bracket (MLC) would be the ideal choice. Decision Tree, Logistic Regression, Random Forest, XGBoost and Neural Network are four machine literacy algorithms that have in- erected support for MLC.

1) *Decision Tree:* Decision Trees are a form of SupervisedMachine Learning. We have used this algorithm for CropMonitoring and Weather Prediction modules..
2) *Logistic Regression:* Logistic regression is a statistical version that makes use of a logistic feature to version a binary structured variable, even though many more complicated extensions exist. We have used this algorithm for Crop Monitoring and Weather Prediction modules.
3) *Random Forest:* Random forests or random decision forests is an ensemble learning technique for class, regression and different responsibilities that operates through building a large number of decision trees at training time. We have used this algorithm for Crop Monitoring and Weather Prediction modules.
4) *XGBoost:* XGBoost gradient boosting is one of the well- recognised gradient boosting techniques . We have used XGBoost for Crop Recommendation Module and the Modelis created using XGBoost as well..
5) *CNN Algorithm:* Convolutional Neural Network is used for Disease Identification Module

C. *Cloud*

Thing speak cloud: Thing speak cloud we used for monitoring Value of the soil moisture temperature Humidity .

V. RESULTS

Result of all module like Crop disease, Crop Recommen- dation Fertilizer , soil Monitoring ,Weather prediction shown below in the images.

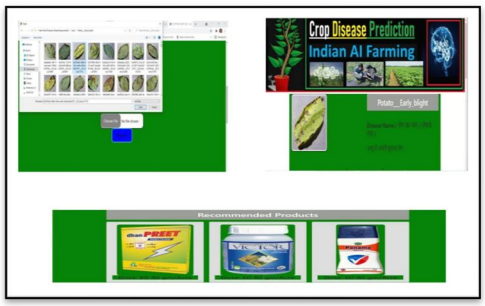


Fig. 2. Early Blight Disease



Fig. 3. Late Blight Disease

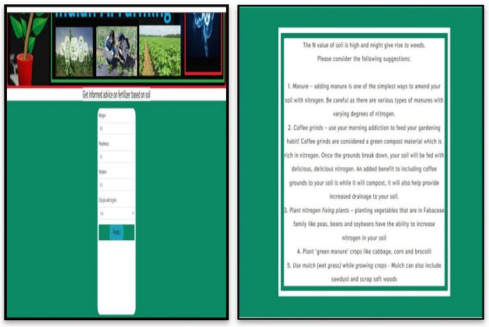


Fig. 4. Crop Fertilizer

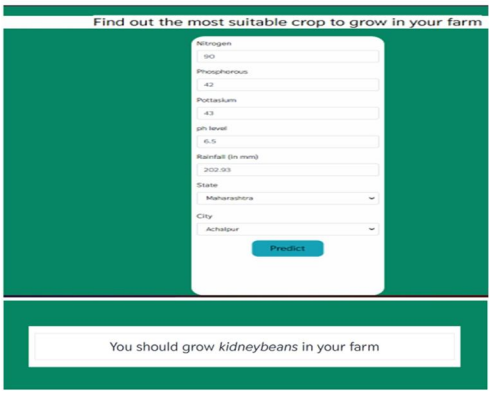


Fig. 5. Crop Recommendation

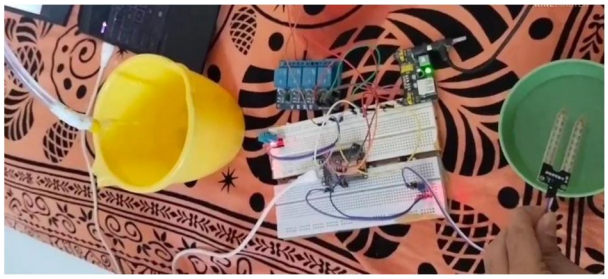


Fig. 6. Smart Irrigation



Fig. 7. Crop Monitoring

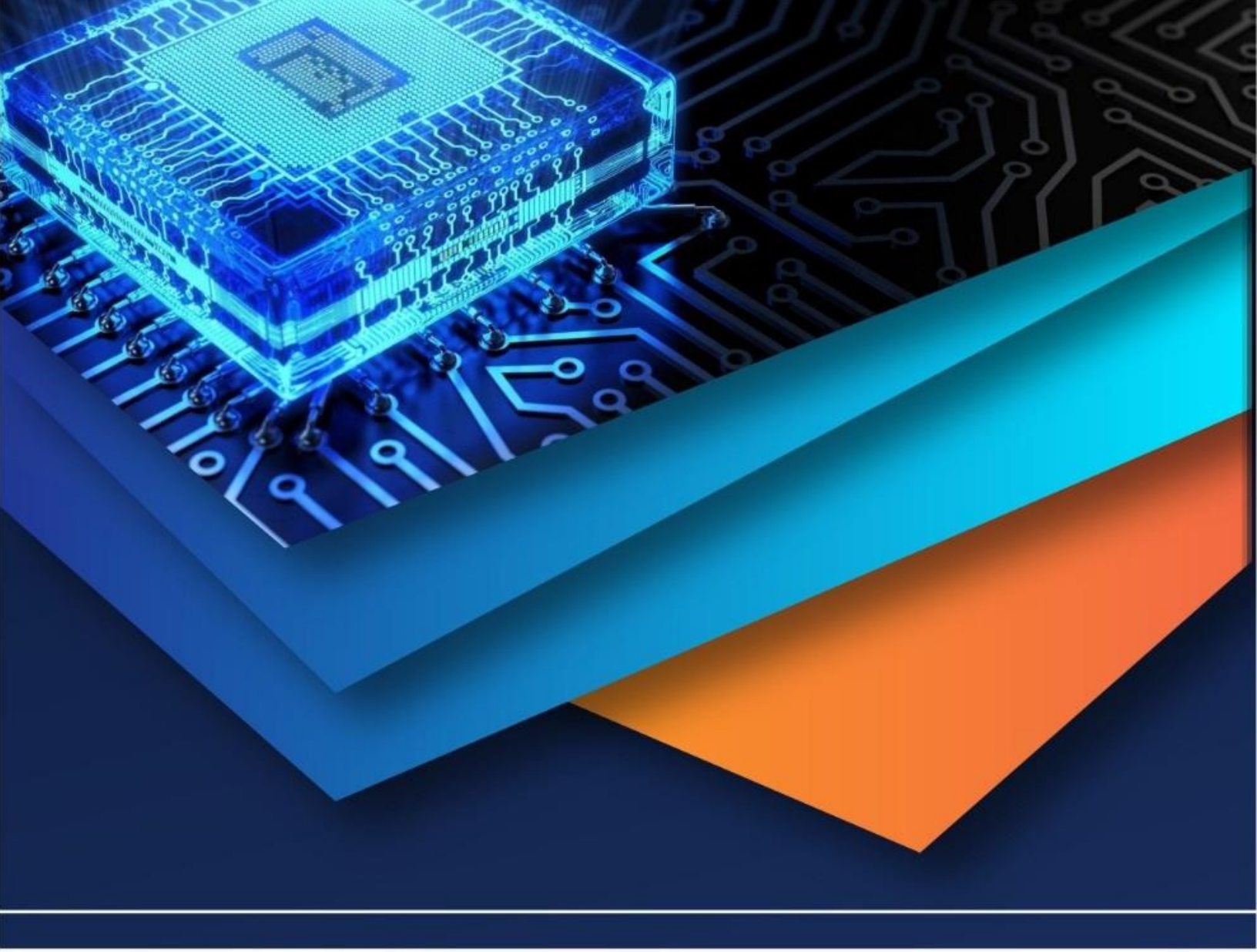
VI. CONCLUSION

The real time data is gathered using sensors such as DHT 11, Soil Moisture which is sent to the Thinkspeak which isan IoT Cloud Platform. Our system uses the data gatheredby the sensors to evaluate and monitor the soil. We haveapplied several ML algorithms like Decision Trees, Logistic Regression and Random Forest for Weather Prediction and Crop Monitoring Modules. A dataset containing more than 5000 images of potato plant crop images is used to perform Disease Identification using Convolutional Neural Networks algorithm. We wish to make our system flexible for usingit on other crops as well. We have also used a dataset forCrop Recommendation and have used XGBoost for creating the model for the same. The Fertilizer Recommendation recommends the type of fertilizer appropriate for the particular soil and recommend crop on the basis of Nitrogen, Phosphorus and Potassium values.

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