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IoT Based Crop Monitoring by using Machine Learning Algorithm

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ABSTRACT: Agriculture is the basic source of food supply in all the countries of the world—whether underdeveloped, developing or developed. Besides providing food, this sector has contributions to almost every other sector of a country. According to the report, 2017, about 17 % of the country's Gross Domestic Product (GDP) is a contribution of the agricultural sector, and it employs more than 45% of the total labor force. In light of the decreasing crop production and shortage of food across the world, one of the crucial criteria of agriculture now-a-days is selecting the right crop for the right piece of land at the right time. Therefore, in our research we have proposed a method which would help suggest the most suitable crop(s) for a specific land based on the analysis of the data on certain affecting parameters like temperature, humidity, air quality and PH of soil using machine learning. In this paper we used geometric progression for predicting best suited crop in field.

KEYWORDS: Temperature, Humidity, Co, Moisture Sensor, ML, GA

I.INTRODUCTION

In a country like India, agriculture is the most prominent sector where the country's major income depends on these fields. About 60% of the land in the country is used for the agriculture and more than 50% of population depends on agriculture. Agricultural Automation especially in developing countries can help on effective yield and reduce human intervention. Now-a-days Internet of Things (IOT) was being used in various sectors. India being an agricultural country needs some innovations in the field of agriculture. For Remote Monitoring of the soil properties we need an IOT based system. Internet of things sometimes referred to as the Internet Of Everything(IOE) which consists of all the web enabled devices that collect, send and act on data they acquire from their surrounding environments with embedded sensors, processors and communication hardware. Various sensors are embedded in the farm to know the soil information.

Basically the soil parameters are Soil pH, soil Moisture, Temperature and Humidity. These basic parameters of the soil will help in characterizing the soil and therefore in taking proper decisions. Machine Learning is an emerging technology which is a subfield of computer science and Artificial Intelligence that focuses on the design of systems that can make decisions and predictions based on the data. Based on the Machine Learning algorithms the crop has been predicted which gives the better yield. This paper is an attempt to study the various Machine Learning as well as IOT techniques applied to the agriculture sector to predict soil moisture, soil PH, and other factors affecting agriculture.

The objective of proposed system is to design and develop an intelligent irrigation system controller which measures the moisture of the soil and temperature of the atmosphere and helps to take decision accordingly to turns on or off the water supply system.

II.LITERATURE SURVEY

The results from paper [1] states that The controller shows the number of hours it should work and a number of times it should water the field and the duration between each cycle, after selecting these parameters the status of the motor is to be selected. IOT based smart farming system can turn out to be extremely useful for agriculturists since over and in addition less water system isn't useful for cultivating. Edge esteems for climatic conditions like stickiness, temperature, dampness can be settled in light of the ecological states of that specific district. This framework creates water system plan in light of the detected constant information from field and information from the climate store. This framework can prescribe agriculturist whether or not, is there a requirement for water system [2].

The featuring highlights of this venture incorporates keen GPS based remote controlled robot to perform undertakings like weeding, showering, dampness detecting, feathered creature and creature terrifying, keeping cautiousness, so and so forth. Also it incorporates brilliant water system with keen control and smart basic leadership in view of precise ongoing field information. Thirdly, it is a brilliant distribution center administration which incorporates temperature support, stickiness upkeep and robbery location in the stockroom. Controlling of every one of these tasks will be

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through any remote brilliant gadget or PC associated with Internet and the activities will be performed by interfacing sensors, Wi-Fi or ZigBee modules, camera and actuators with smaller scale controller and raspberry pi [3].
This project has endeavored to present a productive shrewd homestead framework. It has joined mechanization into different parts of the homestead. Another plan for creature walled in areas is advanced to enhance the living states of domesticated animals, and in addition decrease physical work. It incorporates a computerized light, temperature, moistness and sprinkler framework. The moistness and dampness control components ensure the creatures are agreeable in the fenced in areas they are kept in, by altering the settings according to prerequisite. This will bring about accommodation, vitality effectiveness, and quality and wellbeing benefits [4].
For future improvements it can be upgraded by building up this framework for huge sections of land. Additionally the framework can be coordinated to check the nature of the dirt and the development of harvest in dirt. The sensors and microcontroller are effectively interfaced and remote correspondence is accomplished between different hubs. All perceptions and test emonstrate that this venture is an entire answer for field exercises and water system issues. Usage of such a framework in the field can enhance the yield of the harvests and general generation [5].
6].
'Internet of Things' is far and wide castoff in relating gadgets and social event insights. This horticulture observing framework fills in as a solid and effective framework and remedial move can be made. The created framework is more effective and advantageous for agriculturists. It gives the data about the temperature, stickiness of the air in rural field through MMS to the rancher, in the event that it aftermath from ideal range. The utilization of such framework in the field can propel the collect of the harvests and worldwide creation [7].
Horticulture is an essential wellspring of vocation for People in India. It assumes a significant job in the economy nation. Be that as it may, presently days because of movement of individuals from provincial to urban there is prevention in agribusiness. Observing the ecological factor isn't the finished answer for increment the yield of harvests. There are no elements that diminishing profitability as it were. Subsequently, Automation must be actualized in horticulture to beat these issues. A programmed water system consequently sparing time, cash and intensity of rancher. Conventional Farmland water system strategies require manual mediation. With the mechanized innovation of the water system, human intercession can be limited. Ceaseless detecting and observing of yields by the combination of sensors with the Internet of things (IoT) and making ranchers to mindful about yields development, gather time occasionally and thus making high profitability of harvests and furthermore guaranteeing right conveyance of items to end, purchasers at the ideal place and opportune time. So to beat this issue we go for savvy horticulture method utilizing IoT. This Project incorporates sensors, for example, temperature, mugginess, soil dampness and downpour locator for an assortment of the field information and handling. These sensors are joined with settled web innovation as a remote sensor system to remotely control and screen information from the sensors. [8].
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Agriculture is one of the fundamental wellsprings of the economy and it is likewise primary control of an enormous number of individuals in India this venture a plant sickness identification framework and a programmed water system framework, have been grown together these two frameworks would be of extraordinary assistance to ranchers. The framework recognizes a plant infection called "leaf Blight" utilizing picture preparing innovation with the goal that aggregate move can be made if the discovery is done effectively. This is significant as this malady causes 30%-80% loss of agrarian harvests in the numerous spots in the nation". The programmed dribble water system framework detects the dampness substance of the dirt and discharges water at whatever point fundamentally. Trickle Irrigation and Disease Detection forms are consolidated into one framework utilizing RPi and ESP32 module, Blynk, and DropBox applications are utilized both in work area just as in cell phones to refresh the infection recognized and natural conditions like temperature, dampness and furthermore status of the water system and same can be seen by the rancher. [10].

III.PROPOSED METHODOLOGY

It consists of sensing unit such as Soil Moisture Sensor, temperature sensor to measure water content of soil and the atmosphere temperature respectively and a Wi-Fi module i.e. Node MCU in the transmission and receiving process for transmitting data from sensors to mobile phone and receiving commands from mobile phone.

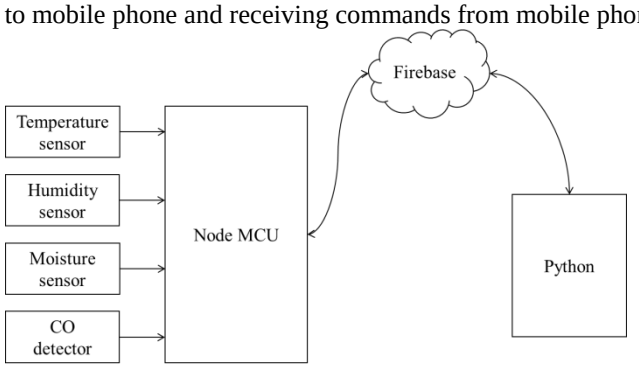

Fig.1. block diagram of proposed system

According to value of different parameters of soil, a list of best suited crop is selected from all crops. Values of different monitoring parameters like temperature, humidity and moisture are shown on mobile app. Value of monitoring parameters are adjusted according to optimal condition required for particular crop. All the data is stored on database. A GUI is developed in Python to suggest a crop which can be grown in farm according to condition of farm. Lookup table is developed accordingly and used to give crop choice by using the environmental conditions.

Algorithm Geometric Progression

A geometric sequence is a sequence such that any element after the first is obtained by multiplying the preceding element by a constant called the common ratio which is denoted by r. The common ratio (r) is obtained by dividing any term by the preceding term, i.e.

where	r	common ratio
	a1	first term
	a2	second term
	a3	third term
	an-1	the term before the n th term
	an	the n th term

$$r = \frac{a_2}{a_1} = \frac{a_2}{a_1} = \cdots \frac{a_n}{a_{n-1}}$$

The geometric sequence is sometimes called the geometric progression or GP, for short.

For example, the sequence 1, 3, 9, 27, 81 is a geometric sequence. Note that after the first term, the next term is obtained by multiplying the preceding element by 3.

The geometric sequence has its sequence formation: $a_1, a_1 r, a_1 r^2, \ldots, a_1 r^{n-1}, a_1 r^n$

To find the nth term of a geometric sequence we use the formula:

$$a_n = a_1 r^{n-1}$$

where	r	common ratio
	a1	first term
	an-1	the term before the n th term
	n	number of terms

Lookup table is developed accordingly and used to give crop choice by using the environmental conditions.

Finding the sum of terms in a geometric progression is easily obtained by applying the formulas:

nth partial sum of a geometric sequence

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$$S_n = \frac{a_1(1-r^n)}{1-r}, \qquad r \neq 1$$

sum to infinity

$$S_\infty = \sum_{n=1}^{\infty} ar^{n-1} = \frac{a_1}{1-r}, -1 < r < 1$$

where Sn sum of GP with n terms

S∞ sum of GP with infinitely many terms

a1 the first term

r common ratio

n number of terms

IV. Result and Discussion

Output of Temperature and Humidity sensor (DHT11) and air quality sensor (MQ135) are connected GPIO pin D4 and D2 of Node MCU (shown in figure 2). Moisture sensor is first connected to converter and then to pin D3 of Node MCU. Operating voltage of all 3 sensors is 5V, which is provided via Vin pin of Node MCU.

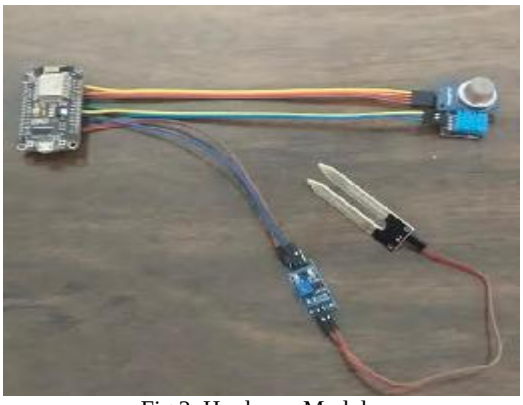

Fig 2. Hardware Module

Table 1 sensor readings and suggested crops for particular values of moisture, temperature and humidity. For example, for soil type Acid sulfate with moisture, temperature and humidity values 25, 80% and 20˚C respectively, Tea is the best suited crop.

Table 1 Sensor Ridings and suggested Crops

Soil Name	Crop	Moisture	Humidity	Temp
Acid Sulfate soil	Rice	25	80	20
Acrisol	Tea	30	97	20
Akadama	Bonsai Tree	40	40	60
Alfisols	Maize	50	70	25
Andosol	Rice	25	80	20
Alluvial soil	sugarcane	60	83	35
Bama Soil	cotton	24	44	48
Aridisol	Pearl millet	30	65	23
Entisols	Rice	22	79	24

Following graph shows different values of temperature, humidity and moisture required for different sensors

V.CONCLUSION

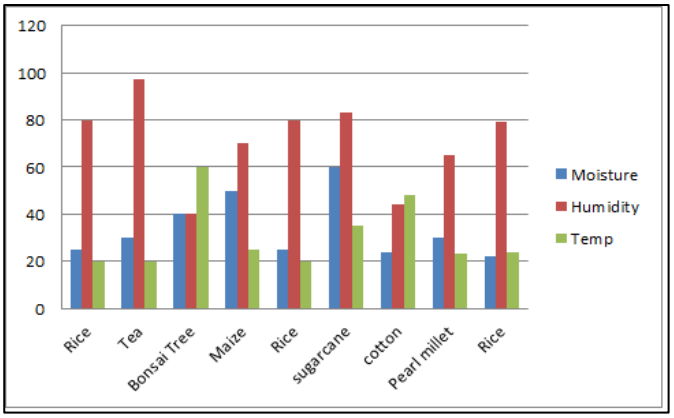

Fig 3. Parameters readings for different cops

System provides an attractive user interface with the most efficient way of controlling the irrigation system. It gives the idea to monitor the soil moisture content and temperature in a farming area and the user can control watering system using Android device provided with Wi-Fi facility. So, the overall implementation cost is cheap and it is affordable for a common person. Considering the present situation, we have chosen Android platform so that most of the people can get benefits. The design consists of Android App by which user can interact and send a control signal to the output of the valve which will control sensors and also monitor the environment. This system of irrigation is also helpful in the region where there is a scarcity of water and improves their sustainability. It is also adjusted according to the need of varieties of the crop to be irrigated. This work can be extended to develop a complete real-time irrigation monitoring system through Fuzzy and Neural network techniques.

VI.FUTURE SCOPE

By further enhancement of this project farmers can bring large areas of land under cultivation. Only the exact amount of fungicide and pesticide can be used. The system can further been improved by incorporating new self-learning techniques which could deployed in the cloud to understand the behavior of the sensing data and can take autonomous decisions. The other problem farmers are facing is the crop destruction by the wild animals. So the future work include the design of the system that may monitor the farm by installing sensors at the boundary of farm and camera module which may take a snapshot once the sensor detects the entrance and transmit the real time pictures by integrating it with other information.

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