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Soil Quality Monitoring and Crop Prediction Using IOT and Machine Learning

Vinu V[1], Prof. Kalpita Mane[2]
[1]*PG Student,* [2]*PG Guide, Department of E&TC Engineering, Ajeenkya DY Patil School of Engineering, Pune, India*

Abstract: ***People are pressured for time in today's fast-paced environment, and technology assists them in a variety of ways. Agriculture is the primary industry in India. As a result, in the current environment, increasing output or production is critical. When it comes to determining certain chemical features of soil that have an immediate impact on plant growth, traditional farming faces various obstacles. Another critical factor to consider is the effect of timely water supply on plant output. The soil alkalinity and electrical conductivity are measured with PH electrodes. This study also looked into the real-time detection of soil variables and the location of chemical properties like pH, humidity, temperature, and soil moisture using a Raspberry Pi as a controller. Semi-supervised learning will be carried out in a methodical manner using the Q-learning algorithm. We used a range of samples in the experiment to show how to apply the indicated performance.***
Keyword: Soil , Crop , Prediction , IoT , Raspberry pi

I. INTRODUCTION

Agriculture is the most important sector of the Indian economy. Agriculture in India generates 18% of the country's GDP and employs half of the workers. Farmers in this new era may use technology to control the complexities of crop management and water consumption. Farmers have obtained modern technology and resources to optimise their revenue as a result of the development of SaaS and cloud computing in recent years, which has resulted in a surge in the number of discriminating consumers and unparalleled temperature values. Unfortunately, many farmers continue to use traditional agricultural practises, resulting in low crop and fruit yields.

Technology, on the other hand, was present everywhere, and people substituted mechanical equipment. Many studies advocate for the deployment of devices that collect data from diverse sources and transmit it to cloud servers over WiFi. The data acquired provides critical insight into certain environmental conditions that require device care. Ecological management needs are insufficient and systematic for increasing agricultural output.

Several other factors have a significant impact on efficiency. Attacks on insects and rodents, for example, can be documented by splattering the area with the relevant insecticides and pesticides. Environmental conditions have an impact on agricultural productivity, production, and labour.

We intend to perform the following in science as a whole.

1) Data production for current soil parameters via an IoT module.
2) Cloud storage for monitoring application performance.
3) Be aware of land production.
4) Planting forecast based on current conditions

In India, agriculture has a long history. Agriculture is one of the most important occupations in India. Because India is a country of millions of villages, a major portion of the population works in rural areas. It is the most diverse economic sector and plays a critical part in the country's overall development. More than 60% of the country's land is dedicated to agriculture in order to meet the requirements of 1.4 billion people. As a result, embracing new agricultural technologies is critical. Current agriculture is heavily reliant on technology and concentrates on maximising earnings from selected hybrid crops, which in the long run degrade the physical and biochemical qualities of the soil. This will lead to profit for our country's farmers. Prior crop forecast and crop prediction were performed based on farmers' experience at a specific location. The crop is an important aspect in agricultural monetary. The crop is affected by a variety of factors, including meteorological, geographic, and financial concerns. Farmers struggle to decide when and which crops to grow. Due to climate unpredictability, farmers are unsure of which crop to cultivate, as well as when and where to begin.

II. LITERATURE SURVEY

As per [1] an idea for coordinating the latest development into farming to modernize the customary water framework methods, empowering simple, worthwhile, and calm managing. A specific measure of robotization is given, empowering the idea of utilizing cloud administrations to screen field and item conditions across significant stretches. Sensors that work sensibly as they are changed are utilized to send off the focal points, for example, water and work saving. The idea of modernizing agribusiness is straightforward, objective, and serviceable. Taking into account these boundary esteems, a farmer may effortlessly conclude which fungicides and bug sprays are utilized for supporting harvest creation.

As per [2] a concentrate on farming IoT utilizes. Open source agrarian programming, IoT-based farming applications, issues, and troubles are entirely covered. Furthermore, this paper presents a layout of how IoT innovation will impact the agribusiness business and help ranchers in dealing with their fields all the more effectively while likewise supporting their earnings.

As per [3] a savvy water system framework that utilizations AI to conjecture how much water a harvest will require. The three most significant factors to consider while assessing how much water required in each agrarian yield are dampness, temperature, and moistness. This framework comprises of sensors for temperature, dampness, and dampness that are put in a rural field and transfer information through a microchip to a cloud-based IoT gadget. To really gauge results, the choice tree strategy, a strong AI method, is utilized to information gathered from the field.

As per [4] exhibit the capability of such advances in the farming area, an energy-productive model fit for natural product ID was proposed utilizing TinyML and LoRaWAN. The consequences of our model's correlation with a cloud-based model for a similar application demonstrated that it was multiple times more energy-proficient and had a high precision level, preparing for another arrangement of PC vision applications in brilliant cultivating that depend on battery-controlled sensors. Albeit the discoveries are empowering, the TinyML worldview has specific constraints as far as on-gadget learning capacities since the brain network should initially be prepared before it very well may be coordinated into the microcontroller unit. Accordingly, the TinyML sensor can't change itself to the specific setting in which it will be utilized.

As per [5] there are two objectives covered. Initial, a versatile application based arrangement that shows the latest sensor readings and successfully empowers field organization from a good ways is shown. Second, a model reconnaissance framework based on the Web of Things is recommended, and it integrates the possibility of multi-class order involving machine and profound learning for the marks clear homestead, horse, cow, wild elephant, and wild pig. To do this, Backing Vector Machines (SVM) and Convolutional Brain Organizations (CNN) were looked at, and the best model was chosen utilizing an exactness measure.

As per [6] the turn of events and testing of a shrewd cultivating framework based on a stage with knowledge that offers expectation capacities utilizing man-made reasoning (simulated intelligence) strategies. The sending of this framework, which depends on remote sensor network innovation, involves three essential advances: (1) information gathering utilizing sensors put in an agrarian field, (2) information cleaning and stockpiling, and (3) expectation handling using specific man-made intelligence methods.

As per [7] the following stage in the development of savvy cultivating and rural practices is IoT-ML based agribusiness. With the utilization of the rural IoT, ML calculations might be applied to information gathered from different ranch contributions to make the framework more intelligent, offer indisputable data, and make forecasts. In this paper, we look at the technique and results of current ML applications in farming, each with novel qualities and downsides. Afterward, proposals were made to put new applications on the IoT since most of ML applications expected continuous information to prepare prescient calculations. By utilizing man-made consciousness (simulated intelligence) innovations that give more noteworthy thoughts and experiences to following work decisions and exercises with an assortment of extreme creation upgrades, ranch the board frameworks are turning into a reality.

As indicated by [8] a plot of land where every individual might start their own farming activity. In any case, ranchers in the advanced climate don't utilize a shrewd system. Consequently, the interest for wise agrarian strategies is rising. To achieve compelling cultivating, new methods from the customary agrarian practices should be presented. Among every one of the issues that ranchers are managing, the most pervasive and critical one is water. Water is scant for cultivating inferable from variable water supply welcomed on by floods and in some cases by dry season. Along these lines, it's critical to oversee water admirably and save frameworks so they can utilize water proficiently on a case by case basis. This study presents an IoT-based water the executives framework to proficiently use, protect, and reuse water for the plants to resolve the issues ranchers experience with the ideal use of water in cultivating.

As per [9] the innovation plays out the water system framework all the more really and offers the two sides with security and constancy. By turning the motor on and off consequently, it brings down water use and empowers compelling water the executives.

This strategy empowers the rancher to watch out for the water system of the field whenever and from any area in the globe. Furthermore, the information examination uncovers the amount of water used for crops, which empowers ranchers to create extra yields as per water accessibility. Consequently, our proposed approach increments horticultural efficiency, diminishes water squander, is savvy, and furthermore limits energy, power, and human association.

As per [10] when utilized in a confined and compelled way in a reasonable climate, IOT frameworks have demonstrated to be prevalent frameworks. Be that as it may, when this approach is utilized in immense farming fields and when different yields are developed, the outcomes should be broke down. Since this approach has created positive results at the miniature level for a situation study, it is likewise exhorted that it be utilized in limited scope farming in country locales.

III. OBJECTIVES

1) To design and develop an approach to Smart Agriculture System using IOT and Machine Learning algorithms.
2) To design and develop an approach that predicts the plantation possibility according to current soil quality.
3) To design and develop a Machine Learning algorithm to predict the scenario for water management on time series data.
4) To explore and validate the proposed system results with various existing systems and show the system's effectiveness

IV. PROPOSED METHODOLGY

Determine crop productivity issues caused by increased or decreased water use in large agricultural contexts. To demonstrate how the proposed solution would address the deficiencies of the existing system. The first overall system was broken into three phases: an Internet of Things (IoT) platform, a database, and a user interface (UI). Because each module is dependent on the others, implementing the data environment aids in removing data inconsistency while maintaining the system's required level of accuracy. The Internet of Things (IoT) kit must be effectively deployed and linked to a cloud database, which contains a Raspberry Pi microcontroller, a DHT-11 moisture sensor, a water motor, and other components.

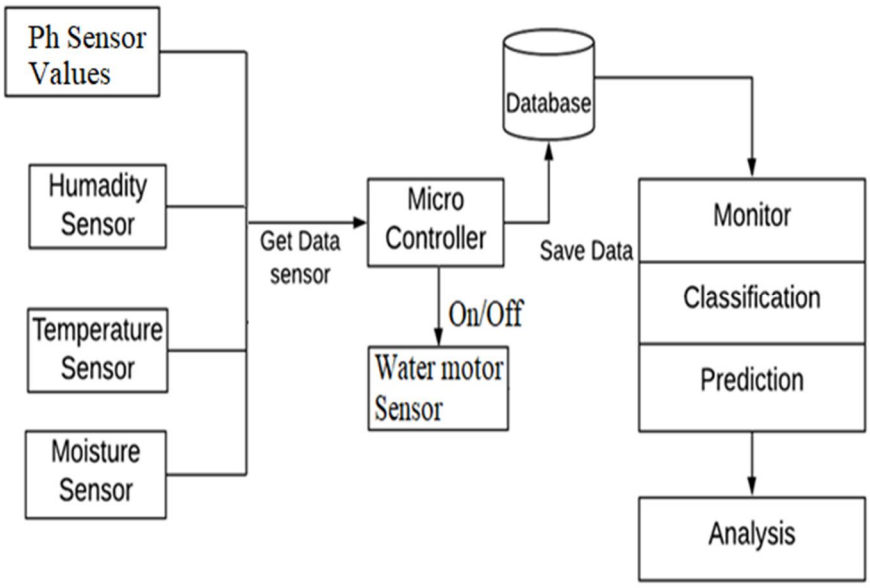

Fig: - System Architecture

The Machine Learning technique, which has been utilised for advised prediction based on their values, must be validated. Finally, depending on the algorithm's output, anticipate the potential need for water. To put into action a suggested system that makes use of an IoT platform to obtain various values from various sensors. Cloud database services should be used to store all runtime data on database servers. Take the data from the server, classify it with machine learning as the base, and evaluate the system's precision. Soil moisture, temperature, and pH levels will be monitored by the farmer. A web application is used to analyse data from sensors using ML techniques. Depending on the parameter and received data the system predicts the best suitable crop which can be planted for farming. To recognize hardware, software, and other system issues.

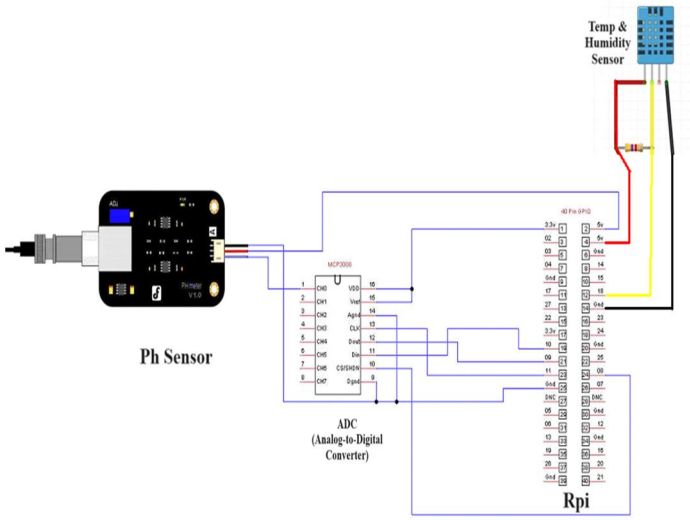

Fig: - Circuit Diagram

V. CONCLUSION

For real-time temperature, pH sensor, and soil humidity data, the module achieves great efficiency and precision. This module will help farmers increase agricultural yields and manage food production more efficiently. It will always assist farmers in receiving more precise live feed from environmental temperature, soil moisture, and certain pH values qualities existing in the soil. The key advantage of this method is that it can be applied to any soil productivity and provides a solid plant forecast in the current environment.

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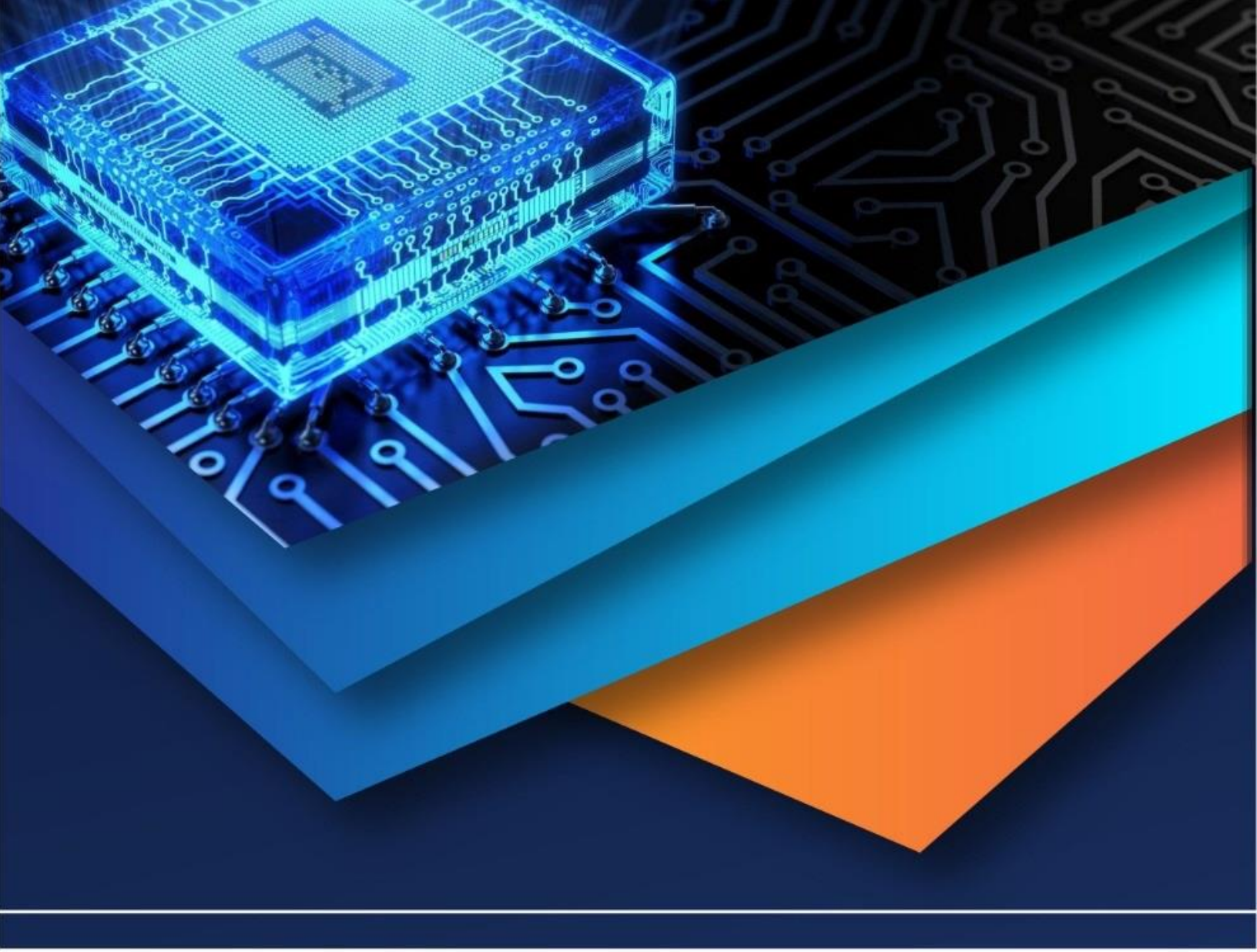

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