

# Application of IoT and Machine Learning in Agriculture

Rajendra Sonu Dhamnak  
Department of Computer Application, ASM IMCOST  
University of Mumbai,  
Mumbai, India, and Pin-400068

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**Abstract** — Agriculture is one of the major resources of economic system in the united states. Precision Agriculture is already in implementation in other international locations however there is a need to put in force, improve and evolve IoT(Internet of Things) and cloud computing technology for better production of the crop. There is a steady increase in demand with populace growth. Modernization in agriculture reduces dependency on man or woman human exertions and land. The era allows operational devising and speeds up verdict making on Farms. IoT permits us to accumulate surrounding facts, stock it, concoct it and disseminate the information. The adoption of cloud computing has gone through a big upward push in need and might continue to grow within the coming destiny with stepped forward cloud hosting and processing dexterities. AI(Artificial Intelligence) and IoT is a tremendous lead as a method to expanded productiveness. The records via IoT gadgets is made available publicly for research purposes as facts sets and is processed and examined for further prediction related to the crop being produced. The Traditional Technique of farming does now not contain any system which include seed choice, soil evaluation, weather analysis, plant life evaluation, Nutrient evaluation if these kind of elements are taken in care, this all might bring a drastic change in the society. The System additionally has a block-chain based delivery system to make certain right distribution with none wastage. Though the pen-paper lifestyle is difficult to be replaced however minimizes a lot of paintings, furthermore the evaluation of guide work required can also be analyzed. A extra complex method to IoT merchandise in agriculture can be represented via the so-referred to as farm productivity control systems. They generally include several agriculture IoT gadgets and sensors, mounted at the premises in addition to a effective dashboard with analytical competencies and in- built accounting/reporting functions. In addition to the indexed IoT agriculture use instances, a few outstanding possibilities consist of automobile tracking (or even automation), storage management, logistics, etc.

**Keywords** — Internet of Things(IoT), Artificial Intelligence(AI), Machine Learning(ML), Smart Agriculture.

## INTRODUCTION

With the populace growth, there's a speedy boom in the call for for meals and agricultural shares and cultivation procedure to improve yield, price-effectiveness, and best of plants/agricultural merchandise being produced with new era including the Internet of Things(IoT) and Artificial Intelligence. There is a need to boom yield, effectiveness and better manufacturing of land per unit region taken below deliberation. It is vital to embrace new technologies to overcome these problems. There are numerous advantages related to the enactment of recent technology which encompass: elevated productiveness, right crop distribution, Crop pattern suggestion, right usage of resources including Fertilizers and manures the use of the method of Automation and AI model.

## OBJECTIVE

The Motive of paper is to detect and determine the nature and great of soil primarily based in a specific region, considering the toxicity stage at gift instance of time and expect it's future value using AI model. The Main targets of the paper are:-

- i. We have a constrained amount of sources and their right usage is a topic of high-quality subject, whether or not it's the utilization of water or usage of minerals from ores all this indirectly impacts our lives.
- ii. Moreover, there is a lack of research data on this area, this will produce a large collection of information for the farmers. Data, tons of facts, accrued by using clever agriculture sensors, e.G. Climate conditions, soil high-quality, crop's boom progress or cattle's fitness. This records can be used to tune the kingdom of your enterprise in widespread as well as workforce overall performance, equipment performance, and so on.
- iii. Better manage over the internal approaches and, as a result, decrease production risks. The capacity to foresee the output of your production lets in you to devise for higher product distribution.
- iv. Being capable of see any anomalies in the crop boom or farm animals health, you will be able to mitigate the risks of dropping your yield.
- v. Increased enterprise performance thru manner automation. By using clever gadgets, you can automate multiple techniques throughout your production cycle, e.g. Irrigation, fertilizing, or pest manipulate.

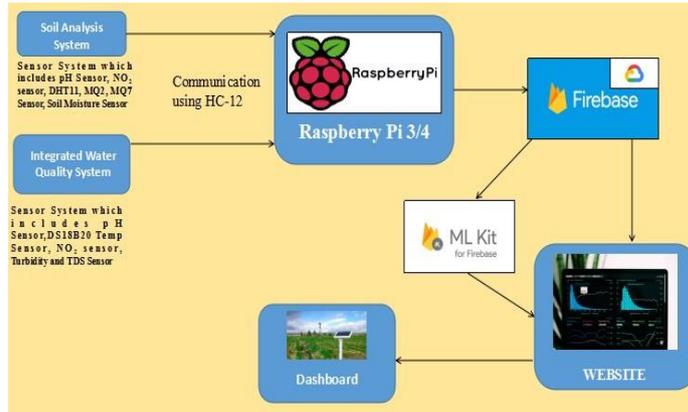
Enhanced product fine and volumes. Achieve better manage over the manufacturing method and hold higher standards of crop quality and growth capacity thru automation.

## LITERATURE SURVEY

In the contemporary synopsis of the industrial revolution, 4.0 in which we've got a confined amount of sources and their proper usage is a subject of top notch problem, whether it's the utilization of water or usage of minerals from ores all this in a roundabout way impacts our lives. With the restrained availability of assets and elevated intake there fees were rising up and so there sustainable utilization is vital. Similarly, inside the case of Farming where we need to feed a big range of clients, any form of loss at any degree proves to be a big loss to the economy and the user as nicely. Moreover, there's a lack of research information on this area. The most important motive is to carry IoT and Machine Applied Farming to India, to enough up the technical software of AI and Machine Learning among Farmers, Researchers, and Government.

## PROTOTYPE MODULE

The scheme structural layout example in Fig. Represents the complete structure of this define. It points records flow in the course of the System. The sensor values used for the same cover temperature and wetness of the surroundings, the moisture content within the soil, it's pH state, salinity, NO<sub>2</sub> attention, and a Unified Water System. The records are received by Google Firebase in which the database resides and the Web Server is hosted on Apache Web Server.



## TECHNICAL REQUIREMENTS

### A. Hardware Requirement:

#### Arduino Mega2560 -

The Arduino Mega 2560 is a micro controller board primarily based at the ATmega2560. It has fifty four virtual input/output pins (of which 15 can be used as PWM outputs), 16 analog inputs, four UARTs (hardware serial gates), a sixteen MHz crystal oscillator, a USB attachment, a energy device, an ICSP header, and a reset key.

It incorporates the whole lot required to help the micro-controller; certainly connect it to a computer with a USB cable or strength it with an AC-to-DC adapter or battery to apply.

#### Temperature and humidity sensor -

DHT22 is a low- fee digital sensor that uses a thermistor to degree the air within the surrounding and it uses a capacitive humidity sensor to measure humidity. They include an NTC temperature sensor/Thermistor to degree temperature. Technically, all resistors are thermistor – their resistance varies slightly with temperature – however the alternate is normally very very small and tough to measure. The humidity sensing element is used, of direction, to degree humidity, which has electrodes with moisture-preserving a substrate (typically a pinch of salt or conductive plastic polymer) sandwiched inside them. The variant in resistance among the two electrodes is equivalent to the relative humidity. The ratio of moisture in the air to the highest quantity of moisture at a selected air temperature is known as relative humidity. The traditional enter voltage range is 3 to 5V and the most cutting-edge allowable is 2.5mA. It is good for -

40oC to 15oC temperature readings with +zero. Five or -zero.5oC accuracy and 0-100% humidity readings with 2-five% accuracy.

### **DS18B20 Temperature Sensor** -

The digital temperature sensor DS18B20 follows a single wire protocol and it can be used to estimate the temperature in the range of -67°F to +257°F or - 55°C to +125°C with +-5% accuracy. The spectrum of acquired data from the 1-wire can range from 9-bit to 12-bit. Because, this sensor supports the single wire protocol, and the regulating of this can be done through an only pin of Micro- controller.

This is a superior level protocol, where each sensor can be set with a 64-bit serial code which serves to control copious sensors using a single pin of the micro-controller. It is a part of the integrated Water System. Use a zero before decimal points: “0.25,” not “.25.” Use “cm3,” not “cc.” (bullet list).

### **MiCS-4514 NO2 Sensor** -

The MiCS-4514 is a compressed MOS Sensor with two fully autonomous sensing elements of one unit. Sensitivity Factor is determined as  $R_s$  in air divided by  $R_s$  at 60 ppm CO. Test conditions are 23°C with an error of 5°C and 50 Rh with an error of 10%. Sensitivity Factor is defined as  $R_s$  at 0.25 ppm NO2 divided by  $R_s$  in air. Test conditions are 23°C with an error of 5°C and 50 Rh with an error of less than of equal to 5%. The Silicon Gas sensor structure consists of an explicitly micro- machined diaphragm with an enclosed heating resistor and sensor panel on top.

### **Raspberry Pi** -

The Raspberry Pi is a low cost, credit card-sized microcomputer that plugs into a computer monitor or TV, and uses a standard keyboard and mouse. It also has very low power dissipation between 0.5W and 1W. New Out Of Box Software (NOOBS) gives the user a choice of the operating system from the standard distributions. Raspbian is the approved operating system for normal use on a Raspberry Pi. In this project, Raspberry Pi essentially demands two purposes. First, server and second for storage. Apache Web Server is hosted on this Pi along with a Firebase database for the accommodation of the data.

### **pH Sensor** -

The pH sensor module consists of a pH sensor also called a pH probe and a signal conditioning board which provides an output that is proportionate to the pH value and can be interfaced straight with any micro- controller. The pH sensor has an Oxidation- Reduction Potential (ORP) Probe which reflects the voltage proportional to the tendency of the clarification to gain or lose electrons from other substances. This voltage and pH have a reducing dependence, lower the voltage higher the pH obtained.

### **MQ2 Sensor -**

Sensitive fabric of the MQ-2 gas sensor is SnO<sub>2</sub>, which with decrease conductivity in easy air. When the goal ignitable fuel exists, The sensor's conductivity is better together with the fuel attention rising. It converts the model of conductivity to evaluate the output sign of fuel attention. MQ-2 gas sensor has a immoderate sensibility to LPG, Propane, and Hydrogen, also may be used to Methane and one-of-a-kind flammable steam, it's miles with low cost and suitable for distinctive utility. It can estimate the concentration of ignitable gases as a good deal as a diffusion of three hundred-10000 ppm. It has a traditional encapsulation of Bakelite.

### **Turbidity Sensor -**

The turbidity sensor detects water best by way of estimating the degrees of turbidity. It adopts light to locate suspended debris in water by way of measuring the light transmittance and scattering charge, which varies with the amount of general suspended solids (TSS) in water. As the TSS increases, the liquid turbidity stage will increase. Turbidity sensors are used to adjust water quality in rivers and streams, waste- water and effluent determinations, manipulate instrumentation for settling ponds, sediment delivery studies and laboratory measurements. This sensor offers analog and virtual signal output modes. The threshold is adaptable when in digital sign mode. You can pick out the mode according to your MCU. If you depart the sensor in the natural water, this is NTU < zero. Five, it ought to output "4.1±0.3V" whilst the temperature is 10o~50oC. The Operating Temperature of Turbidity meter is 5o~90oC.

## **B. Software Requirement :**

### **Raspbian OS -**

Raspbian is a Debian-based totally (32-bit) laptop working gadget for Raspberry Pi. There are several variants of Raspbian along with Raspbian Stretch and Raspbian Jessie. Though Raspbian isn't designed to work the Pi like a computer computer presents the users with an LXDE computing device history. The Pi ingests not have a exceptional deal of processor pace or reminiscence, however it does have sufficient aid to run LXDE and a number of the applications like the simplistic Epiphany net browser and several more similarly.

### **Arduino Software -**

The Arduino Integrated Development Environment (IDE) is a cross-platform utility (for Windows, macOS, Linux) that is written in functions from C and C++. Arduino is an open-source electronics platform primarily based on easy-to-use hardware and software. It is used to jot down and upload programs to Arduino like minded forums, however additionally, with the assist of 3rd birthday celebration centers, different vendor improvement boards. The Arduino IDE supports the languages C and C++ the use of unique policies of code structuring. The Arduino IDE employs this system avrdude to transform the executable code into a text document within the hexadecimal encoding that is loaded into the Arduino board via a loader application inside the board's firmware. By getting inputs from sensors, Arduino senses the environment and affects or influences its environment with extraordinary actions and actuators. Arduino is obliged to bring together and add the necessary codes to run the UNO.

## **Apache Web Server -**

Apache internet server is a unfastened and open-supply go-platform web server software advanced and maintained by using Apache Software Foundation. It powers around forty% of web sites round the world. It is brief, strong, and safe. It can be profoundly custom designed to fulfill the needs of many exceptional environments with the aid of the use of branches and modules. In this task, this server is needed to reveal the obtained statistics and carry out the essential assignments after the information illustration and processing. The server is what is answerable for monitoring the fitness of the plants and also to take control of the automatic water sprinkling device. In this undertaking, the server is hosted at the Raspberry Pi.

## **Firestore -**

The Firestore Real-time Database is cloud- hosted. Data is saved as JSON and synchronized in real-time to each connected consumer. When you expand cross-platform apps with our iOS, Android, and JavaScript SDKs, all your clients percentage one Real-time Database prevalence and automatically accumulate updates with the most current statistics.

### SMART MOBILE APPLICATION:

The planters are the cease-customers of this application. This utility will offer full radio connectivity to the farmers for their farm. The concocted statistics from the cloud will be received by the farmers the usage of the mobile software. The farmers will get a graphical example of information as properly for extra suitable comprehension of the parameters. With the assist of this facts precis, the farmers could be aware of the climatic occasions of the farm and therefore will constrain the accessories inclusive of light and motor pumps. Each farmer will have its personal account with the aid of which he can log in utilizing an person username and password. New customers can record the use of their electronic mail ID and create a new account. The farmers will get the direct readings from the sensors for the node they have got decided on. Based on this they may additionally get an alert for which tool ought to be switched on or off.

The operators can hence take a look at for the readings and wirelessly alter the devices for the sphere. Apart from this the utility additionally provides different beneficial offerings for the farmers as follows:

### CONCLUSION

This Paper proposed an IoT and AI-primarily based scheme for the Agricultural Sector which include an assemblage of Micro- controllers, sensors, and a Consolidated Water Quality System. In this technique, the statistics consolidated from Sensors will be transferred to Cloud for processing and Data set company through the Internet. The actual-time facts could be fed into an ML set of rules after a sure constant c language of time, primarily based on which it might be expecting the soil circumstance of the gadget. For predicting the variable parameter of Soil, the Regression approach might be used but checking the Toxicity of Water Anomaly detection method is maximum suitable.

This machine will be aid furnished to the farmers for digitalize agriculture. Approximating viable paintings in this gadget may also entail amassing the records and rendering offerings for every crop solely.

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