IoT-Based Smart Agriculture System

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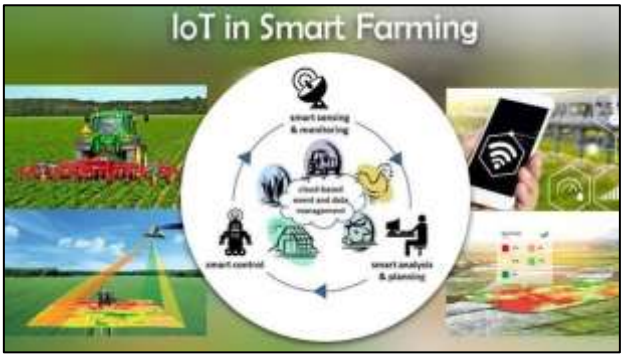
Abstract— The farming of agriculture began 1200 times lower again, neolithic age gave the start to civilization, Farming, and later endured as usual farming practices. India is an agricultural country, and substantially Indian farming is dependent on rains, soil, moistness, and environmental challenges. Our growers upgraded to ultramodern state-of-the-art technology in civilization. Encyclopedically, IoT systems have contributed to its application in many fields and have proven to achieve success. it is time that Indian farmer wishes to introduce Smart Agricultural systems for higher crop yields. Productivity with the compilation of data from detectors, selectors, and ultramodern digital gadgets the farmer can monitor agrarian fields. Smart Agriculture can study rainfall data, rainfall data, switching ON the pump motor, and admit the moistness of soil in phrases of moisture stages with the assistance of sensors that are interfaced to the technique module Arduino- UNO. The Smart husbandry device can be operated from somewhere with the assistance of networking technology.

Keywords: IoT, Sensors, Submersible Motor, Microcontroller, Effects to Consider Before Developing Your Smart Farming Solution

I. INTRODUCTION

The identification of the methods of clever farming can supply improvements to the deteriorating standard agricultural sector. The use of clever methods like Precision husbandry, positive water operation, and Soil humidity and humidity monitoring are sure-shot strategies to amplify yield per acre of land. Precision Agriculture avoids the indecorous and redundant operation of fungicides and fertilizers and allows the farmer to use the land of its exceptional nature. Precision Farming is a possible salvager at a time when the water tables in India are diminishing at a quick charge due to unheard-of demand for a useful resource in the agricultural and artificial sectors. Growers nevertheless procrastinate or are cussed with typical practices and extend in implementation can also similarly the first-rate the GDP in India. Recently experts received migrants all over India who had back to their natives at some point during the Pandemic Covid-19 had chosen farming as their career and are no longer fascinated to head again. these settlers can now cross-test smart husbandry structures as it takes lesser time than normal farmers to persuade the adoption of the perpetration of Smart husbandry systems.

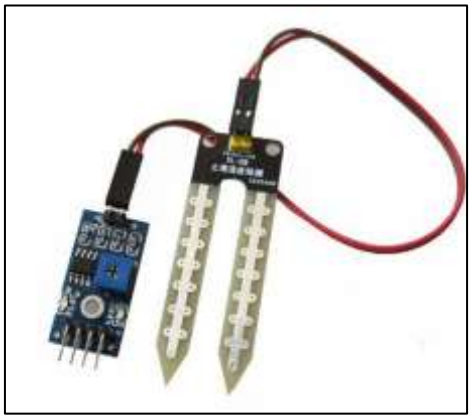
II. PROPOSED SMART FARMING SYSTEM



The device suggested making use of a microcontroller (nodemcu) which has a Wi-Fi module (ESP8266) over it. A smartphone with a blank is used as a consumer interface. soil moisture sensor, humidity and temperature sensor (DHT11), and rain find sensors alongside a submersible motor are used. These DC motors are linked to a water pump which pumps water to the vegetation when the DC motor is ON. The soil moisture sensor senses the humidity characteristic in the soil [1]. Depending on the degree of moisture, nodemcu decides whether or no longer to water the crop or no longer [2]. By the use of splendid features and tentative statements in the regulation written for thenodemcu functioning, the watering of the crop starts via way of nodemcu making DC motor ON when the soil has sufficient moisture, and the motor is growing to become OFF when there is adequate moisture content material in the soil. The humidity and temperature detector gives the moisture and temperature values of the atmosphere which determine whether the crop is suitable for growth [3]. Some crops grow only in particular rainfall conditions, and some give better yield only for a particular temperature range. The raindrop sensor measures the depth of rain. If there is enough downfall to give the soil the needed the crops are not doused. indeed, after rainwater, if the plants are not having sufficient water also water is pumped again by making the dc motor on. data reaches the blynk cloud from nodemcu through Wi-Fi from the Wi-Fi module present on nodemcu [4]. the records also go to the Blynk app on the smartphone where the user can see the humidity, temperature, and soil moisture levels and get notifications if there's rainfall and if the DC motor is ON. Various buttons and switches can be controlled by the farmer from this app. while the nodemcu receives the command from the app then the applicable evaluation is done, and the dc motor is managed. the records again travel through Wi-Fi in the same path.

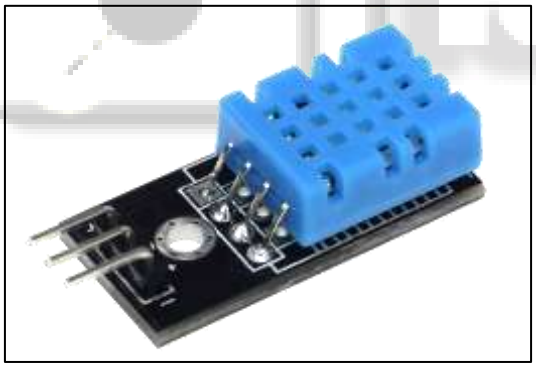
III. SENSOR:

A. Soil Moisture Sensor



A soil humidity detector is a detector that senses the moisture content of the soil. The sensor has both analog and virtual affairs. The virtual affair is constant, and the analog output threshold may be colorful. It works on the principle of open and short circuits. The output is excessive or low indicated through the LED. When the soil is dry, the current will not pass through it and so it'll act as an open circuit. For this reason, the affair is stated to be maximum. When the soil is wet, the current will pass from one terminal to the other and the circuit is said to be short, and the affair will be zero. The sensor is platinum carpeted to make the performance high. The range of sensing is also high. It is anti-rust and so the sensor has a long life which will afford the farmer at a minimum cost.

B. Humidity and Temperature Sensor (DHT11)

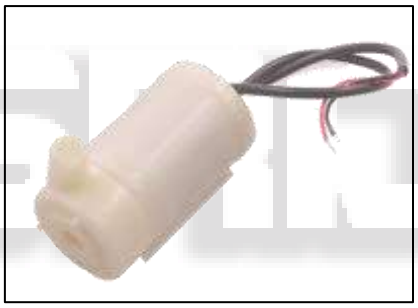


The humidity and temperature sensor (DHT11) shown in the Figure, consists of a thermistor, humidity sensing component, and an IC. A thermistor calculates the temperature of its surrounding medium from its capability of varying its resistance due to temperature. A moisture-holding substrate is placed between two electrodes in the moisture-sensing component. The variation in moisture produces a variation in resistance between electrodes. The variation in resistance is measured and reused by the IC which gives the humidity value to the nodemcu. This detector operates at a voltage range of 3.3V to 5V. The range of temperature is 0 - 50°C, range of humidity is 20 - 90% RH.

C. Raindrop Sensor

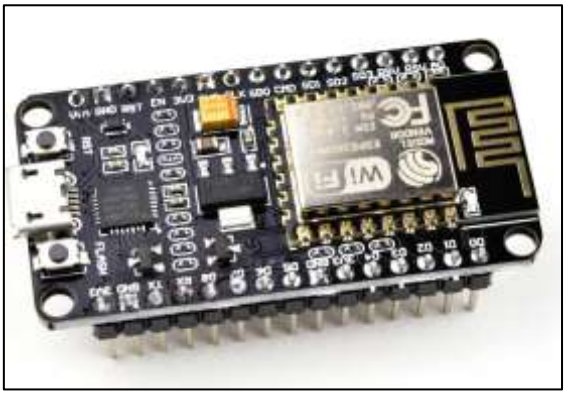
In the raindrop sensor shown in Figure as Drops fall on the nickel lines, the drop connects these lines in parallel which reduces the resistance, and hence the voltage drop across the lines is also reduced. This happens because water is a good captain of electricity. So, when the voltage drop is much less than a positive price it suggests that it's raining. The module has a rain board, a control board, a power index LED, and an adjustable sensitivity through a potentiometer. Its operating voltage is 5V. The range of resistance is from 100kohm to 2mohm.

IV. SUBMERSIBLE MOTOR



The motor in Figure converts DC electrical power into mechanical power. It works on the principle of Lorentz regulation. The Submersible motors can move in both clockwise and anticlockwise directions depending on the sign of voltage applied between their terminals. The DC motor operates at vary of three to 9V and runs at a velocity of 3000RPM

V. MICROCONTROLLER



Nodemcu is an open-source IoT platform that includes firmware that runs on the ESP8266 Wi-Fi module.

Programming is done in Arduino IDE using C/ C language or Lua script. Nodemcu has sixteen GPIO pins which can be used to manage different peripheral units like sensors, LEDs, switches, and so far. Those pins also can be used as PWM pins. It has two UART interfaces and uses XTOS operating system [5]. It can store 4M Bytes of data. The operating voltage of nodemcu is 5V. It uses an L106 32-bit processor, and the processor's speed is 80-160mhz. Blynk is an open-source platform designed for iot which can control hardware remotely can display sensor data, can store data, and visualize it. The components of this platform are a server that can be run privately or used the common one, an app, and libraries. Every time some information is given from the Blynk app, the information travels to the Blynk Cloud, from there it automatically finds its way to the tackle. The connection between the pall and then the app can be through Wi-Fi, Bluetooth, GSM, Ethernet, etc. The state of hardware pins can be manipulated by the commands given in the Blynk app through colorful kinds of widgets present. The authentication token is generated after every design is created and it is a unique identifier that connects the hardware and the phone. The data from Humidity and temperature sensor and raindrop sensor is sent to the digital pins of the nodemcu. The data from the Soil moisture sensor is sent to the analog pin of the nodemcu. DC motor is connected to the nodemcu via robot which is connected to two digital pins of nodemcu. The serial monitor displays the data given by sensors if serial functions are written in the law and if periodical communication between the nodemcu and the device exists. The name of the Wi-Fi network and password are written along with the Authentication commemorative in the law to connect the hardware to the Blynk app. When the code is dumped into the hardware, from also the status of the crops and soil along with the DC motor status is seen on the phone when connected to Wi-Fi.

VI. EFFECTS TO CONSIDER BEFORE DEVELOPING YOUR SMART FARMING SOLUTION

As we can see, the use instances for IoT in agriculture are endless. There are numerous ways smart bias can help you increase your farm's performance and profit. still, husbandry IoT app development is no easy task. There are certain challenges you need to be apprehensive of if you are considering investing in smart farming.

A. The Hardware

To builds an IoT solution for agriculture, you need to choose the detectors for your device (or create a custom one). Your desire will rely on the kinds of records you choose to gather and the reason for your answer in general. In any case, the quality of your sensors is pivotal to the success of your product: it will depend on the accuracy of the collected data and its reliability.

B. The Brain

Data analytics should be at the core of every smart agriculture result. The amassed statistics themselves will be of little assistance if you can't make feel of it. Therefore, you need to have important data analytics capabilities and apply predictive algorithms and machine learning to obtain actionable insights based on the collected data.

C. The Maintenance

Maintenance of your hardware is a challenge that is of primary importance for IoT products in agriculture, as the detectors are generally used in the field and can be easily damaged. Therefore, you need to make sure your tackle is durable and easy to maintain. else, you'll need to replace your sensors more often than you would like.

D. The Mobility

Smart farming operations should be acclimatized for use in the field. A business proprietor or ranch director should be able to access the information on-site or remotely via a smartphone or desktop computer. Plus, each connected device should be independent and have enough wireless range to communicate with the other devices and send data to the central server.

E. The Infrastructure

To ensure that your smart farming application performs well (and to make sure it can handle the data cargo), you need a solid internal structure. Furthermore, your internal systems must be secure. Failing to duly secure your system only increases the likeliness of someone breaking into it, stealing your data, or indeed taking control of your autonomous tractors.

F. Connectivity

The need to transmit data between numerous agrarian installations still poses a challenge for the relinquishment of smart husbandry. Dispensable to say, the connection between these facilities should be reliable enough to withstand bad weather conditions and ensure non-disruptive operations. Today, IoT devices still use varying connection protocols, although sweats to develop unified norms in this area are presently underway. The advent of 5G and technologies like space-grounded Internet will, hopefully, help find a result to this problem.

G. Data Collection Frequency

Because of the high variety of data types in the agrarian assiduity, icing the optimal data collection frequency can be problematic. The data from field-grounded, upstanding, and environmental sensors, apps, ministry, and outfits, as well as reused logical data, can be subject to restrictions and regulations. Today, the safe and timely delivery, and participation of this data is one of the current smart farming challenges.

H. Data Security in the Agriculture Industry

Precision agriculture and IoT technology implies working with large sets of data, which increases the number of implicit security loopholes that perpetrators can use for data theft and hacking attacks. Unfortunately, data security in agriculture is still, to a large extent, a strange concept. Many farms, for example, use drones that transmit data to the ranch ministry. This ministry connects to the Internet but has little to zero security protection, like stoner watchwords or remote access authentications. Some of the basic IoT security recommendations include monitoring data business, using encryption styles to protect sensitive data, leveraging AI-based security tools to descry traces of suspicious activity in real-time, and storing information in the blockchain to make

sure its integrity. To completely profit from IoT, growers will have to get familiar with the data security concept, set up internal security policies, and adhere to them.

VII. CONCLUSION

In this paper, we can propose a technology it is used to read and dissect the systems that enable checking the quality of the soil and the growth of the crop in soil, and with these systems, farmers can solve irrigation problems, temperature problems, humidity problems, etc. The vacuity of sensors for the agricultural parameters and microcontrollers can be easily interfaced with each other and with the help of the Internet of Things IoT capable to control the condition of the yield and growth, it can also be suitable to check soil, temperature, humidity, etc. With help of it [6].

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