Smart Agriculture using IoT

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Abstract:

Internet of Things (IoT) innovations helping to gather data about conditions like climate, dampness, temperature and ripeness of soil, Crop web based checking. The technology permits ranchers to get associated with his homestead from any place whenever. Remote sensor systems are utilized for observing the homestead conditions and smaller scale controllers are utilized to control and computerize the ranch forms. Remote cameras have been utilized to see remotely the state of the structure and advanced mobile phone enables rancher to know the ongoing conditions in any part of the world. This paper proposes the techniques used in IoT based agriculture.

Keywords: Agriculture, Internet of Things, Remote Sensors, Remote Cameras

1. Introduction

In India, agriculture plays a vital role and its growth is necessary for the development of economic condition of the country. India, whose GDP relies upon the farming is certifiably not a created country as far as modernization in horticulture. The significant expense of work, vulnerability in the creation of yields, absence of information about new strategies, proceeding with the equivalent customary and conventional intends to go about horticulture, the wasteful utilization of appropriate irrigational offices brings about low efficiency. Because of this vulnerability in the water system process the yields may likewise evaporate. About 14.7 % of India's development relies upon the horticultural division, so it's an enormous reason for concern. Though many farmers still use the traditional methods of farming which yields less amount of crops and fruits. However automation in agriculture will be improve yields [1].

To respond the issues that emerge in horticulture regarding water system, fertigation, natural conditions, for example, temperature, precipitation, mugginess, wind speed, soil humus substance or supplements and so forth, we have proposed the accompanying thoughts. The blast in Information Technology (IT) industry is currently opening another route for controlling the gadgets and estimating the temperature, stickiness and dampness utilizing the idea of Internet of Things. Web of Things (IoT) makes it simple to play out a few errands of gathering information, spreading the information, moving the information to break down them and to anticipate or recommend the arrangement using sensors. There are bunches of issues looked in Agricultural Industry in cultivating.

Various IoT sensors for ascertaining the dampness, temperature and stickiness were united and incorporated with the Arduino board for figuring the measure of water utilization for each plant. Savvy horticulture would be imaginative and accommodating for the ranchers. One of the requirements of the Indian Agriculture was the water utilization of a plant and in many regions the water is getting squandered. Along these lines, to direct the use of water for each plant without getting squandered. The significant accomplishment of the work is to limit and direct the measure of water that is being utilized for agribusiness without squandering it. This must be done if the dampness, temperature and mugginess of the rural land are known. Along these lines, those qualities were taken for ascertaining the edge which restricts the measure of water utilized for water system. Potentially the greatest accomplishment of all to come was completing the framework which works progressively.

In IoT-based shrewd cultivating, a framework is worked for checking the harvest field with the assistance of sensors (light, moistness, temperature, soil dampness, and so on.) and mechanizing the water system framework. The ranchers can screen the field conditions from anywhere. Here we took in the strategies for coordinating the IoT sensors together with the Arduino board and getting the edge esteems for computing the water utilization of the plant. IoT-based shrewd cultivating is profoundly proficient when contrasted and the ordinary methodology. As far as natural issues, IoT-based savvy cultivating can give incredible advantages including progressively productive water use, or advancement of sources of info and medicines.

Build up a framework which will have the option to tell the dampness and moistness of the plant through the IoT sensors. By computing the edge estimations of dampness and dampness we will have the option to roughly tell the measure of water required for the plants in that rural field. To respond the issues that emerge in farming as far as water system natural conditions, for example, temperature, precipitation, mugginess, and so on., IoT gives an answer for control every one of these things and give answers for oversee them. The target of the technique are as per the following:

- Simple and simple to introduce and design.
- Saving vitality and assets, so it tends to be used in legitimate manner and sum.
- Farmers would have the option to spread the perfect measure of water at the opportune time via mechanizing homestead or nursery water system.
- Avoiding water system at an inappropriate time of day, decrease spillover from overwatering immersed soils which will improve crop execution.
- Automated water system framework utilizes valves to turn engine ON and OFF. Engines can be mechanized effectively by utilizing controllers and no need of work to turn engine ON and OFF.
- It is exact strategy for water system and an important device for precise soil dampness control in profoundly particular nursery vegetable creation.
- It is efficient, the human mistake disposal in changing accessible soil dampness levels.

2. Literature Survey

It introduced the framework and hub models of WSNs, the related components, and order as indicated by particular applications. It review the diverse accessible remote sensor hubs, and the different specialized strategies followed by the senodes [2]. Exactness

Agriculture (PA) used WMSN to empower capable water system. It portray about IoT and WMSN in agribusiness applications particularly in green house condition. It very well may be clarified and shown the proficiency of criticism control system in green house crop water system. A test was directed to see the unmistakable these two procedures. The strategies are water system by timetable or criticism based water system. Water system by plan is to supply water to the plant at express time-ranges. Input based water system is to inundate plant when the dampness or level of media wetness came to predefined regard. The test shows that there is a normal reserve funds of 1,500ml for regular per tree. In a nursery situation utilizing WSN or WMSN, the test demonstrates explicitly that a nearby circle framework or a programmed water system is better differentiated to planned water system. Programmed water system will enhance the use of water and manure and further more keep the wetness or dampness level of the harvest to be about at the comparable level as prompted by agronomi [3].

Srishti Rawal et. al. the proposed framework presented in a GSM module based on Base station framework. Base station framework is utilizing a microcontroller, GSM module, sensors and actuators. In commonsense activity, the focal station gets and sends messages through GSM module [4]. An automated irrigation system to reduce water usage in agriculture by consolidating the Internet of Things (IoT), cloud computing and optimization tools. The automated irrigation framework deploys low cost sensors to detect [5]. Ecological conditions varieties will impact the general yield of the harvest. Plants require authentic very certain conditions for ideal development and wellbeing. Watching the state of yield field is particularly fundamental so sensors are utilized. Temperature infrared thermopile sensor-TMP007 is used, it as worked in computerized control and math motor [6]. Rubeena et. al. suggested an efficient method to solve the farming resources optimization and decision making. Also they proposed internet of things technology is very useful for precision agriculture systems [7].

Different environmental parameters are measured by wireless robot which is equipped with variety of sensors. The robot may can be perform the tasks such as moisture sensing, spraying pesticides, moving forward or backward and switching ON/OFF electric motor [8]. Nikesh Gondchawar and R.Complexion. Kawitkar advance the quick improvement of agrarian modernization and help to acknowledge brilliant answer for horticulture and productively explain the issues identified with ranchers [9]. M.K.Gayatri et.al have proposed a technique to picture and follow rural items in inventory network [10]. Lustiness. R. Nandurkar et. al centre around the equipment engineering, arrange design and programming process control of the exactness water system framework [11]. Paparao Nalajala et. al. have proposed an approach to direct water in rural fields [13]. Joaquín Gutiérrez et. al. have concentrated on the investigation on the use of distributed computing and the web of things in horticulture and ranger service [14].

3. Proposed System

In the field segment, different sensors are sent in the field like temperature sensor, dampness sensor and moistness sensor. The information gathered from these sensors is associated with the Arduino. In control fragment, the got data is checked with the cutoff esteems. On the off chance that the information surpasses the limit, esteem the client gets a message. Different parameters like the temperature, dampness, and dampness shows the limit esteem and the water level sensor is utilized just to demonstrate the degree of water inside a tank or the water asset. The necessities of the framework are classified into the as follows:

- **Soil Moisture sensor:**

Soil dampness sensors measure the volumetric water content in soil. Since the direct gravimetric estimation of free soil dampness requires expelling, drying, and weighting of an example, soil dampness sensors measure the volumetric water content in a roundabout way by utilizing some other property of the dirt, for example, electrical obstruction, dielectric consistent, or communication with neutrons, as an intermediary for the dampness content (Figure 1a). The connection between the deliberate property and soil dampness must be adjusted and may fluctuate contingent upon ecological factors, for example, soil type, temperature, or electric conductivity.

- **Digital humidity and temperature sensor (DHT11):**

DHT11 Temperature and Humidity Sensor includes an aligned computerized signal yield with the temperature and stickiness sensor complex. Its innovation guarantees the high unwavering quality and amazing long haul steadiness. This sensor incorporates a resistive component and a feeling of wet NTC temperature estimating gadgets (Figure 1b). It has phenomenal quality, quick reaction, against obstruction capacity and significant expense execution points of interest.

- **Relay driver:**

The 2-Channel Relay Driver Module (Figure 1c) makes it straightforward and advantageous to drive loads, for example, 12V transfers from basic 5V advanced yields of user Arduino good board or other microcontroller. User can utilize any of the control channels autonomously, so basically leave any unused channels separated.

- **Bread board:**

A breadboard is a solderless gadget for transitory model with hardware and test circuit plans. Most electronic parts in electronic circuits can be interconnected by embeddings their leads or terminals into the gaps and afterward making associations through wires where fitting (Figure 1d).

- **Connecting wires:**

A wire is a single, regularly round and empty, versatile strand or bar of metal. Wires are used to oversee mechanical weights or force and media correspondences signals. Wire is regularly encircled by pulling in the metal through an opening a kick the basin or draw plate (Figure 1e)**.**

- **Arduino UNO R3:**

The Arduino Uno R3 is a microcontroller board dependent on a removable, double inline-bundle (DIP) ATmega328 AVR microcontroller. It has 20 computerized input/yield pins (of which 6 can be utilized as PWM yields and 6 can be utilized as simple sources of info). Projects can be stacked on to it from the simple to-utilize Arduino PC program. The Arduino has a broad help network, which makes it an extremely simple approach to begin working with implanted gadgets. The R3 is the third, and most recent, modification of the Arduino Uno (Figure 1f).

- **DC motor (12 v):**

A DC engine is any of a class of revolving electrical machines that changes over the direct flow electrical vitality into the mechanical vitality (Figure 1g). The most widely recognized sorts depend up on the powers created by attractive fields. About a wide range of DC engines have some inward system, either electromechanical or electronic, to occasionally alter the course of current stream in part of the engine.

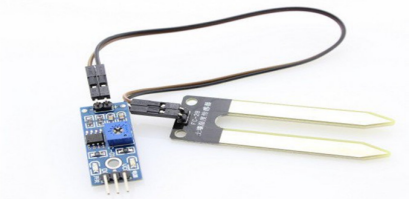

Figure 1a. RS200 Moisture Sensor

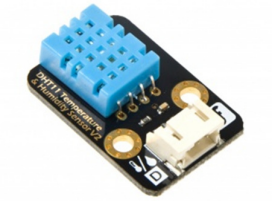

Figure 1b. DHT11

Figure 1c.Relay Driver

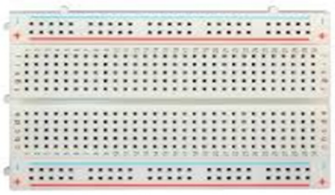

Figure 1d. Bread Board

Figure 1e.Wires

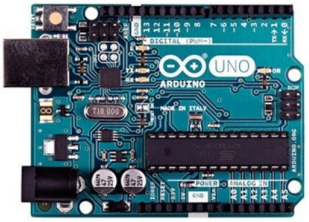

Figure 1f. Arduino Uno R3

Figure 1g . 12 V DC Motor

The general blueprint portrayal of the working of the framework was planned and it is as follows

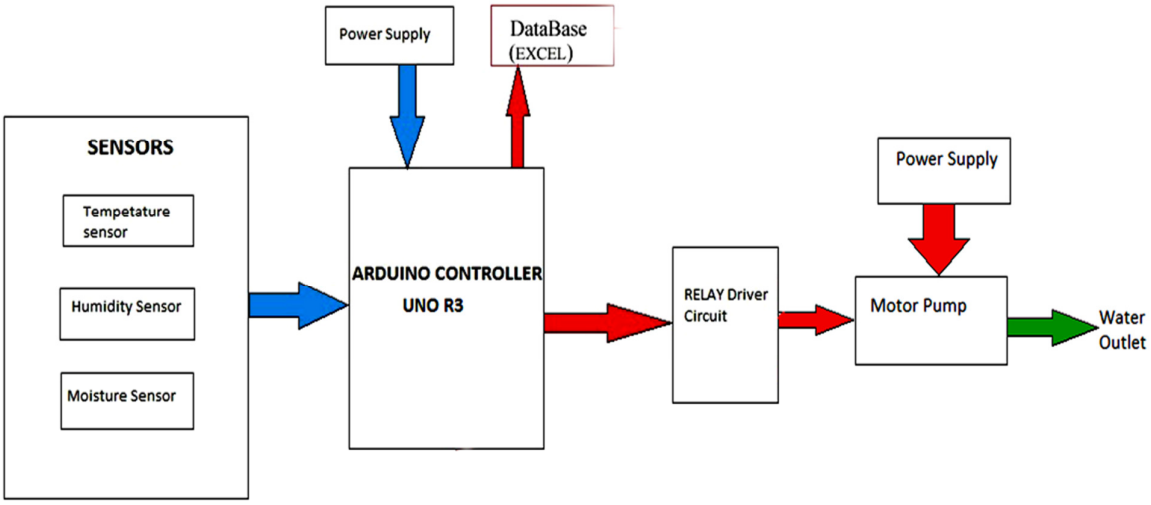

Figure 2. Block Diagram

There are three functional components in . They are the moisture sensors, DHT-11 module and the relay driver module are for motor pump. Thus, the Arduino Board is programmed using the Arduino IDE software. The function of the moisture sensor is to sense the moisture content present in the soil, DHT-11 sensor is to sense the temperature and humidity in the air. The relay driver is used to initiate the power supply so that, the water pump supplies water to the plants.

This project uses microcontroller Arduino Uno board to controls the motor and monitor the sensors. Follow the schematic diagram to connect the Arduino to the relay driver, and the driver to the water pump. The motor can be driven by a DC supply, we can also supply power from external source or from Arduino board. The Arduino Board is programmed using the Arduino IDE software. The product is developed based on the above block diagram.

For every product that is being developed it is very important to divide the modules before developing. Because it paves the way for parallel development and then finally combining it by integration. Likewise, the modules for this product include:

- Assembling phase
- Analysis phase
- Manipulation phase

Assembling phase

In assembling phase, the sensors are placed in the field and we connect the sensor to the microcontroller(Arduino). After assembling of sensors over the field we have to collect the values through sensors. From sensor, values to be passed to the microcontroller(Arduino).

Analysis phase

In analysis phase, the analysis of water capacity taken by the plant at each stage of growth. With help of the time period of the plant planted.

Manipulation phase

In manipulation phase, by applying the algorithm with help of calculated threshold value and obtained field information.Perform the operations according to the result obtained in manipulation.

After getting a working product, each time, it undergoes testing to verify whether the requirements are satisfied. The common types of testing used in the system were software testing in which the Arduino software was tested by running the demo code available in the software. Hardware testing was performed on the moisture sensor, temperature sensor and the jumper pins. Regression testing was performed by checking the performance of the system. And also stress testing was also performed for continuous twenty-four hours testing. And also, black box testing for checking the reachability of the code by creating a lot of test cases.

The test parameters included

- Testing for a single plant
- Testing group of plants
- Testing results and product usability

First, the test has to be done for a single plant in home by placing the sensors in the plant pot and getting the sensor value and manipulation carried out. This testing is carried over the domestic gardens. Where the sensor works properly and senses the approximate value and gives the correct moisture level throughout the place. For some other testing we don't get the accurate result because there exists none of the algorithm that is 100% efficient. So, the calculated accuracy of the system which was close to 80%.

4. Conclusion

Inculcating Industry 3.0 in agriculture will help us to increase the contributing of Agricultural Sectors in Indian GDP from 16% to 60% at least. Increase in Agricultural productivity will also increase the exports from the country. This will in turn increase the value of an Indian rupee. Thus, the standard of living will itself increase. Our future enhancement is going to develop it in Industry 4.0, because now a day its very upgrowing technique in most of the industry. Its fully automated and when we go for cloud storage and

when we include inter disciplinary then we can achieve Industry 4.0. We have planned to use image processing technique to increase the accuracy of the product. Similarly, we the robots will automatically check the type of plant and it will calculate the water level for each plant.

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