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SMART IRRIGATION AND FERTILIZER DISPENSING SYSTEM USING SOIL AND PLANT DATA ANALYSIS

Pathu T Olirmathi N Kishore Kumar M Mervin.S Department of Electronics & Department of Electronics& Department of Electronics& Department of Electronics& Communication Engineering, Communication Engineering, Communication Engineering, Communication Engineering, SNS College of Technology, SNS College of Technology, SNS College of Technology, SNS College of Technology Coimbatore, Tamil Nadu, India. Coimbatore, Tamil Nadu, India . Coimbatore, Tamil Nadu, India Coimbatore,Tamil Nadu,India pathu.t.ece.2021@snsct.org olirma.n.ece.2021@snsct.org kishore.m.ece.2021@snsct.org mervin.s.ece.2021@snsct.org

Abstract—

Most of the Agriculture lands in India are over fertilized with some nutrients and some nutrients are Deficient in the same lands and Maximum lands are Overhydrated which results in water wastage. India holds 17% of the world population but only 4% of fresh water is available in India In this 80% of water is spent for Agriculture purposes alone. Nowadays each and every domains are getting automated but watering the crop with fertilization accordingly to the soil nutrients and plants is not in progress. Current automatic watering system uses only a soil moisture sensor and water the plant accordingly to the humidity alone. Here we develop an IOT based watering and fertilizer dispensing system which is fully automated accordingly to the soil and plant needs. The soil data and plant nutrients required data is initially collected and code is created accordingly and dumped in Arduino and the code can be changed once in a year or once in a plantation season so that the proper cycle can be ensured . This proposed system results in the proper usage of fertilizers and water in an efficient manner. This also paves the way for full fledged Automation in the Agriculture field.

Keywords:

Internet of Things (IOT), smart irrigation, soil moisture sensor, Water level sensor, Temperature, humidity

I. Introduction

Agriculture is the most important sector of the Indian economy. A nation that consistently grows its agricultural output can be sustainable in the global economy. A nation like India offers excellent weather conditions for cultivating a variety of agricultural crops. However, in India, land and water are the more valuable elements. Of these two, insufficient water supplies have the most significant and widespread effects on crop productivity. Water scarcity therefore has a tremendous influence on the production of food. Lack of water makes it difficult for farmers to cultivate crops, which necessitates the inability to feed the world's expanding population. Domestic, industrial, and agriculture uses account for 70% of total groundwater use, according to the International Water Management Institute (IWMI).

Irrigation is a mechanism for transforming water into food or cash crops to increase agricultural productivity. The efficient use of water hasn't been reduced by the use of irrigation systems in an optimized manner. Due to this, either more water is consumed than is necessary or insufficient water is available to maintain healthy crops

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As stated by the World Bank, an irrigation management system works to support and upgrade current groundwater level irrigation systems and enhances irrigated areas to enhance the number of crops that might be cultivated.

Since it has been established that irrigation systems' effective use of water has boosted agricultural development. But the timing of water sprinkling depends on choices like when to irrigate and at what level. In the modern period, automated equipment have taken the place of traditional techniques for watering plants. One advantage of automated irrigated agriculture is that they reduce water and electricity costs, reduce inconsistent watering, and ensure that plants receive the necessary amount of water by minimizing water waste. It is not the right method of farming to waste water by irrigation water agricultural land that already has adequate humidity when considering water scarcity into consideration. Hence, one should decide that the agricultural land of that location before controlling watering.

Using the ESP8266 Node multipoint control unit

(MCU) module and also the digital temperature and humidity sensor (DTH11) sensor, we are developing an IOT building irrigation system in this work. Moreover, a thing speak server is used to track the condition of the land and detect the topsoil moisture levels. Fire sprinklers are also agriculturally systems inside which that water flows through tubes to provide plants with the water they require. The smart technology can determine how much water is required based on the land's environmental conditions, including moisture, temperatures, and humidity, and the electricity will be put on to give enough plants with water.

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The automated systems that are currently in have used have limitations, including the capacity to store data permanently for subsequent use while also sending alert messages or SMS to a mobile device. The purpose of the research is to supply automated devices for a smart irrigation system and to store the data in an IOT cloud. The automatic watering system is also constructed using a circuit for a rain alert and a sensors for soil moisture.

The following describes how the paper was organised: While Section 2 addresses the library research, Section 1 discusses the need for irrigation systems and improvements to IOT cloud-based smart irrigation infrastructure. Following Section 3, which presents the materials and proposed methods of research, comes Section 4, which offers the experimental analysis. The paper concludes with the 5th Section

II. LITERATURE SURVEY

Jinling et al. proposed a remote measurement and management system for greenhouses based on the Global System for Mobile GSM-SMS which thus sends security patches on the humidity and temperature of the green walls through the use of SMS and by remote machines. The systems are governed to water the plants which use sensors and automated processes. [1]. Gautam and Reddy proposed an innovative GSM Bluetooth predicated remote controlled
embedded system for irrigation [2]. Suresh et.al have proposed an architecture predicated on the capabilities of current and next-generation microcontrollers and their application requisites[3]. Microcontroller utilized for the system is promising that it can increment system life by decreasing the puissance utilization resulting from lower power consumption. Kansara et.al has proposed astute irrigation system utilizing IOT [4]. They proposed the technology of irrigation where the human intervention can be minimized. if there is a change in temperature and sultriness of the circumventions the sensors reads the

aread to be irrigated [5]. Sensors are present to check the presence of water in the field. Once the field desiccates sensors sense the requisite till the sensors is deactivated again. Anitha have proposed and garbage monitoring system using IOT using sensor on lid of the garbage bin detects the level of garbage based on the height of the bin [6].

Uddin et.al proposed a model of variable rate automatic microcontroller predicated irrigation system [7]. The only power source used to operate the entire system is solar power. On the paddy field, sensors are positioned; these vicissitude in temperature and sultriness and gives signal to interrupt the micro-controller to make the contrivance on or off. Archana and Priya proposed a microcontroller predicated system that supervises the water level and the sensor data monitor the water level and communicate this information to the farmer. Farmers can find out the water level without having to go to the paddy fields. A farmer can regulate the engine based on the water level by sending a message from his cellphone even from a distance. However, if the water level reaches the danger level, the motor will start on its own without the farmer's consent to establish the ideal water level in the area. Chavan and Karande had planned to create a wise wireless sensor network (WSN) for a farming scenario. analyzing various aspects of both the agricultural environment, like as soil moisture temperature and sultriness along with other factors can be of paramount[8]. A traditional approach to quantify these factors in an agricultural environment betokened individuals manually taking quantifications and checking them at sundry times. This paper investigates a remote monitoring system utilizing Zigbee. These nodes send data wirelessly to a central server, which amasses the data, stores it and will sanction it to be analyzed then exhibited as needed and can additionally be sent to the client mobile. Anitha have proposed home security system using IOT [9]. By sending a notification to the user, the system will inform the owner of just about any unauthorised users or whenever the door is opened. The user can take the required actions after he receives the message. The security system will employ a WiFi module, ESP8266, to connect to and communicate using the Internet, a magnetic Reed sensor to monitor the status, a buzzer to sound the alarm, and a microcontroller known as Arduino Uno to interface between the components. The convenience of construction, significant reductions, and ease of maintenance are among the system's main advantages. An irrigation method based on soil humidity has indeed been discussed by Parameswaran et al. [10]. Based on the solenoid valve, a water level sensor is used to evaluate whether damp the soil is.MATERIALS AND METHODOLOGY

A smart irrigation system is configured using essential components as listed as follows.

- ARDUINO Uno
- DHT ll Temperature and Humidity Sensor
- Connecter wire
- Bread Board, Laptop
- Water level Sensor
- Soil Moisture Sensor.

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1. Arduino Uno

The open source Arduino Uno PC application combines the parts in accordance with the programming language and combines the business with the customer to produce microcontroller packs. These micro-controlled packs are utilised as an intelligent agent that was developed to identify and manage power system in the real universe. In Fig. 1, an exemplary Arduino Uno is illustrated. In general, Arduino boards cost less dollars and are employed with many different operating systems. It is simple and customizable for beginners. It operates with numerous other languages, notably C++ and Java.

Fig.1 Arduino Board

2. DTH11 Sensor:

The DTH-11 sensor is an extremely popular device used for measuring temperature and humidity with an accuracy of +0.5 degree courses. On the rear of the sensor, the DTH 11 sensor has an IC, a temperature controller, and a moisture sensing sensor. It incorporates both 4 and 3 pins. Figure 2 illustrates an illustration of how to connect that use the DTH-11 detector..

Fig.3 Soil Moisture

is a cheap Wi-Fi module. It has dual
and drive the entire application and
-controller units. It's working power
ıas a built-in TCP/IP stack.

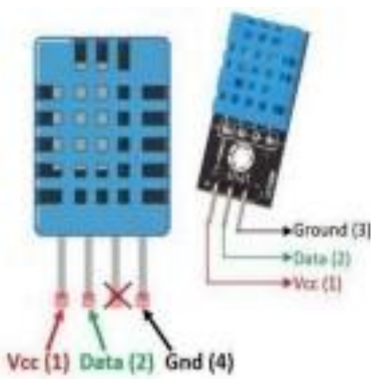

Fig.2 : DTH-11 Sensor

3. Soil moisture sensor

The Fig.3 shows a sort of soil moisture sensor. It contains two tests by methods for which current will go into the dirt, at that point scrutinizes the obstruction of the soil,

which will peruse the dampness level. We know the nearness 5. Water Level Sensor

Fig 4. Wifi Module

the opposition into voltage.

of the water makes the dirt more inclined to lead the power effortlessly, which implies R(resistance) is less in the such kind of soil, while dry soil has poor conductivity of intensity, in this way dry soil upholds more insurance than the wet soil. Sensor is structured on this property of intensity. There should be a point that believers the obstruction into voltage, this is done using circuit which show inside the sensor, which changes over

The Water Level Sensor is a simple-to-use, inexpensive unreasonable level/drop fame sensor that is obtained by having a series of parallel wires exposed after anticipated beads/water amount so it can determine the water level. To immediately determine the influence of the level alarm, an Arduino development board can be swiftly read to produce simple esteems and smooth to finish water..

Fig 6. Water Level Sensor

Specifications of the Water level sensor is given as follows:

voltage: DC3 5V

current: less than 21mA

Type: Analog

Detect Area: 4ommx16mm

Humidity: 11% -90% non-condensing

Product Dimensions: 62mmx2ommx8mm

6. Bread Board and jumper wires

Fig . 7 Bread Board

Fig.8 Jumper wires

A breadboard is a solider less contrivance for ad interim template with test circuit designs. A bounce wire (generally called jumper, jumper wire, jumper interface, DuPont wire, or DuPont interface – named for one creator of them) is an electrical wire or social occasion of them in a connection with a connector or stick at each end (or from time to time without them– essentially "tinned"), which is commonly utilized to interconnect the

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sections of a breadboard or other model or test circuit, inside or with other hardware or parts, without soldering. Singular bob wires are attached by implanted their "end connectors" into the initial way gave in a breadboard, the header connector of a circuit board, or a touch of test outfit.

III. PROPOSED METHODOLOGY

The primary aim of the study is to develop a framework to stay track of remote soil wetness from an abroad area and to deal with the moisture of soil so it doesn't influences the products. The IOT basically based arranged framework given amid this examination are valuable to achieve such an undertaking. The prototype framework examination of this study enables monitoring any agricultural arrive and keeps up moisture of the dirt. This thought will unquestionably encourage any country move to sensible Agriculture. The framework is foreseen to figure and create records in period. The real execution of the framework would require changes in detecting component, innovations and supply code in spite of the fact that the approach and control remain steady. The proposed system was demonstrated with the help of Thingspeak cloud. ThingSpeak is an IOT analytics place to accommodate to sanctions to aggregate, depict and analyze real-time data streams in the cloud. ThingSpeak gives instant envision of data posted by the contrivances with the competency to execute MATLAB code. Additionally , it is often utilized for prototyping and proof of concept IOT systems that require analytics.

A. Proposed system

The data is first collected from the different sensors here Sensors like Moisture level of soil, Temperature of the area, air moisture and Water Level are used. They are attached to a breadboard which is intern connected to the Arduino Board. The data from the board is sent to the Arduino IDE. The programming language that is used runs instructions which extracts the data and reflects. If the data is not valid then the process endsis clearly shown in Fig. 9 and Fig. 10

Fig.9 Proposed system

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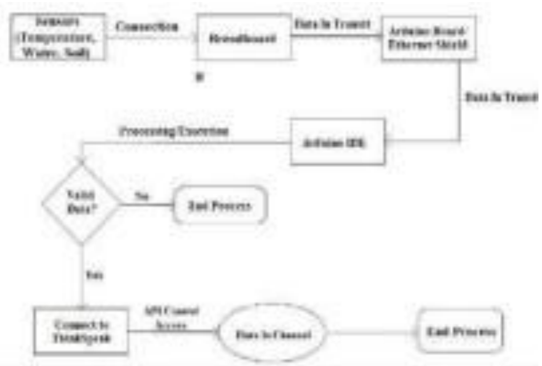

Fig.10 Data flow diagram of the proposed system

IV. IMPLEMENTATION OF THE PROPOSED SYSTEM

In the proposed system, we effectively develop a framework which can help in a programmed water system gadget through concentrate the dampness level of the field. The shrewd water system contraption ends up being a valuable gadget since it robotizes and manages the watering with no guide intercession. The essential bundles for this mission are for agriculturists and plant specialists who do now not have enough time to water plants.

The dampness sensors and temperature sensor degree the dampness degree (water substance) and temperature of the unmistakable vegetation. On the off chance that the dampness level is situated to be underneath the coveted level, the dampness sensor sends the flag to the Arduino board which triggers the Water Pump to appear ON and supply the water to particular plant. The machine might be likewise drawn out for out of entryways utilization. The working model of the proposed system was depicted in Fig.11 and Fig.12.

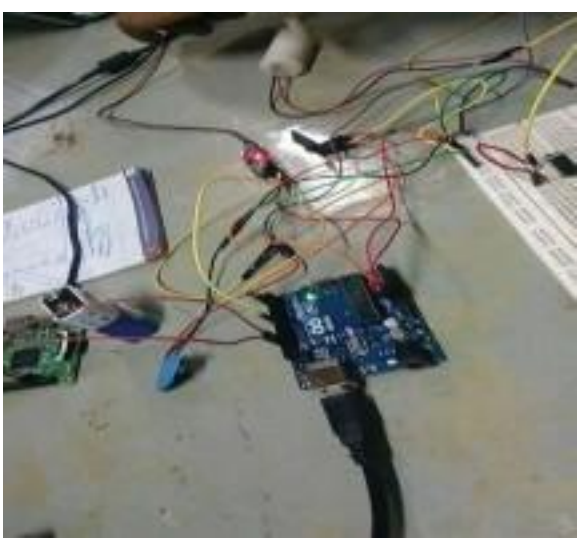

Fig 11. Working model of the proposed system

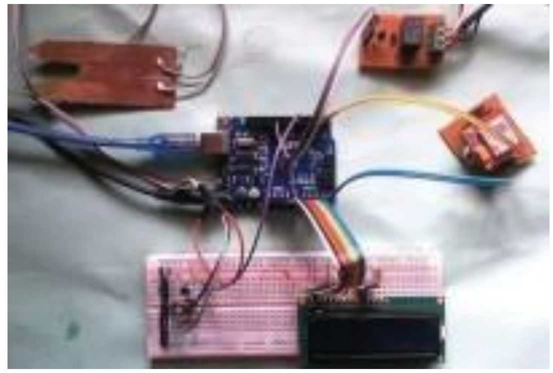

Fig 12. Complete connection of the proposed model

V. EXPERIMENTAL ANALYSIS

The experiment was carried out by taking the input from the DHT11 sensor. The moisture sensor gives analog output which can be read through the ESP8266 NodeMCU analog pin A0. Since the NodeMCU cannot give output voltage greater than 3.3V from its GPIO so we are using a relay module to drive the 5V motor pump. Also the Moisture sensor and DHT11 sensor is powered from external 5V power supply.

The data collected from various sensors are listed in the table below. Table.1 contains the data from Temperature sensor, humidity sensor, Soil moisture sensor and water level sensor indicated as attributes as A1,A2,A3,A4 respectively.

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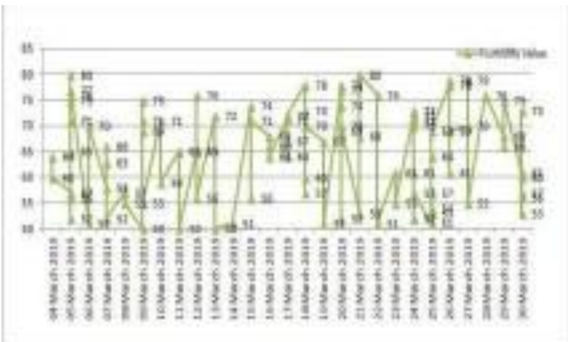
Table 1. SAMPLE DATASET

Created at Date	Created Time	entry id	A1	A2	A3	A4
09 March 2019	07:22:24	113	35	51	49	1076
23 March 2019	07:28:31	191	40	72	48	547
17 March 2019	06:18:24	138	37	71	44	589
22 March 2019	07:19:52	118	29	68	40	1324
13 March 2019	07:27:16	132	32	51	49	562
23 March 2019	08:05:10	174	37	61	33	1129
09 March 2019	07:21:28	165	36	61	45	703
19 March 2019	06:01:54	172	33	77	45	674
21 March 2019	08:36:26	180	38	53	34	1379
20 March 2019	07:37:26	180	26	78	32	1230
08 March 2019	08:49:11	176	28	50	28	1385
14 March 2019	07:48:11	113	36	70	25	421
20 March 2019	08:08:36	105	38	57	35	1401
10 March 2019	06:59:37	108	29	71	46	1369
11 March 2019	06:30:22	159	40	78	27	304
14 March 2019	07:46:55	105	32	71	37	1242
23 March 2019	07:03:52	130	36	61	33	948
16 March 2019	07:50:15	148	39	79	39	356
08 March 2019	06:10:09	128	30	80	31	625
05 March 2019	06:09:10	107	26	67	35	729
20 March 2019	08:58:26	175	36	71	31	659
23 March 2019	06:33:05	159	38	64	43	986
26 March 2019	07:02:14	108	34	55	25	368
19 March 2019	06:21:19	146	34	57	43	1388
28 March 2019	08:11:07	161	25	65	41	589
19 March 2019	08:14:18	146	34	66	39	804

The temperature recorded by the DTH11sensor from the various dates and from various time period on various places of Vellore shown below in Fig. 13.

Fig 13. Temperature recorded by DTH-11 Sensor

Similarly, the humidity recorded by the DTH11 sensor form the various places are depicted in the graph below as Fig. 14.



14. Humidity recorded by DTH-11 Sensor

The soil moisture level recorded by the soil moister sensors are depicted graphically in Fig.15.

Fig 16. Water level recorded by water level sensor

These data are loaded into to the Thingspeak cloud for display, and a correlation between temperature and humidity is computed. Watering plants is greatly influenced by the connection between temperature and humidity. We could thus turn on or off the irrigation system depending on the correlation. Using the Mat lab conceptual model and thingspeaks, the association is presented in the following Fig.

Fig. 18 Arduino workspace

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The proposed work is new because, up till now, most irrigation system research has focused on data recording and notifying owners by SMS or alarm when it's necessary to water or switch off the water supply. However, utilising the information gathered from sensors installed, the offered work automatically turns on and off. The collected information is also saved in the cloud for additional use..

VII . CONCLUSION AND FUTURE WORK\

In the future, this process will also be automated in a manner that is simultaneously efficient and cost-effective because the data gathering for soil and plant nutrition requirements is similar to a service process that must be repeated once each season or once per year. The water level and the sand content are crucial factors in the creation of an intelligent irrigation system. In general, a wide variety of factors, such air temperature, soil temperature, air humidity, ultraviolet radiation, and much more, have an impact on soil moisture. This study indicated anInternet of Everything (IoT)-based smart irrigationsystem that would use sensors to collect data and store it in the cloud. Using the data that has been collected, future study could involve predicting thesoil moisture, that may be cost-effective and affordable.

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