AGRICULTURE IN 2020: THE DREAM OF FARMERS

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ABSTRACT

The internet of things (IoT) is an emerging technology that portrays the possibility of physical objects being connected with the internet and having the capacity to distinguish themselves from different gadgets. One of the significant uses of IoT is smart agriculture. Real task of smart agriculture is to cultivate & convey it to the end customers with the most ideal cost and quality. The quality of the crop essentially depends upon the factors like soil moisture, adequate temperature & the presence of desired chemicals within the soil. This paper fundamentally manages the convergence of agriculture with the IoT by utilising different sensors with the end goal to check the diverse parameters that deals with viable production of crops, prompting automation of water supply to the fields and to check the continuous environmental temperature, humidity and moisture substance of the soil which additionally encourages us to productively use electric power, water and to decide the measure of different chemicals required for the soil like (N,P,K).

Key Words: IoT, Smart Agriculture, sensors, temperature, humidity, moisture.

Abbreviations: IoT (Internet of Things), NPK (Nitrogen, Phosphorus, Potassium), LDR (Light-Dependent Resistor), GPS (Global Positioning System), USB (Universal Serial Bus), pH (Power of Hydrogen), PHP (Personal Home Page), SQL (Structured Query Language).

1. INTRODUCTION

The Internet of Things (IoT) is an immense platform which helps different devices and sensors to communicate over the internet in a close continuous way. A sensor-based framework is produced to screen the field. The states of the field can be seen by the farmers from anyplace with the combination of IoT. The farms can use this data to rapidly investigate the information, for example, climate administrations, to enhance basic requirements for their crop [6][7]. The harvest must be provided water in legitimate amount. A lot of water can choke out the plant roots and too little will be unable to support the plants. Recognizing the right yield water necessity is basic. Field information assembled from sensors can accomplish an abnormal state of precision in the count of water necessity. The global population is set to contact 9.6 billion by 2050. In this way, to sustain this much population, the cultivation technique should be managed by IoT in opposition to the demanding situations, for example, outrageous weather situations and rising environmental changes, and environmental impact coming about because of extreme cultivating practices, the interest for greater sustenance need to be met. All around arranged water system is extremely basic for getting ideal product yields. For legitimate water system planning, sound information of the soil dampness status, edit water necessities, soil thickness, pH estimation of soil is essential to augment profits and to check the utilization of water and energy.

2. LITERATURE SURVEY

Nelson Sales, Artur Arsenio [1] this paper described Wireless Sensor Networks. The system performs three hubs i.e. acquisition, collection and analysis of data such as temperature and soil moisture. The advantages of irrigation process in agriculture are decreasing water utilization and ecological aspects. Cloud computing is an appealing answer for high stockpiling and handling abilities of expansive measure of data by the Wireless Sensor and Actuator Network. This work intends to agriculture, nurseries, fairways and landscapes. Architecture is categorised in to three fundamental parts: a WSAN segment, a cloud stage segment and a client application segment. It contains three unique sorts of hubs such as sink hub, a sensor hub and an actuator hub. SimplitiTI is a straightforward convention for WSAN usage in a bunch tree topology. The soil moisture screens to assess the plants it requires water for its legitimate advancement and enhancement of regular assets.

Rajalakshmi.P, Mrs.S. Devi Mahalakshmi [2] proposed idea in order to monitor the crop land using various sensors like soil moisture sensors, temperature and humidity sensor, light sensor and automated the irrigation system. According to their proposal data from the sensor is sent oven a wireless network & the data is stored in server using MySQL & PHP [8]. By determining the threshold limit for their crop their system is automated. The parameters used here are soil moisture sensor, temperature and humidity sensor DHT11, LDR used as light sensor and web server – NRF24L01 used for transmitter and receiver. This system is more efficient where the water scarcity is more.

Joaquín Gutiérrez, Juan Francisco Villa-Medina, Alejandra Nieto-Garibay, and Miguel Ángel Porta-Gándara [3] has developed an algorithm in which threshold value temperature, soil moisture is programed into a microcontroller. This system enables the user to remote monitoring [9] of the fields & have a duplex communication link based on cellular user interface enables to inspection of fields &with the help of webpage irrigation schedule is managed.

Y. Kim, R. Evans and W. Iversen [4] here a remote sensing field irrigation system is developed using distributed wireless sensor networks in order to monitor & to control of a site specific precision linear move irrigation system to enhance the productivity of the cultural lands by minimizing the utilization of energy. The whole system works with five sensors that collects the data from the fields & send it to the base station using GPS (Global Positioning System) where the control command is assigned to database available with the system. This system provides wireless solution in remote controlling for precision irrigation in an economical way.

3. MOTIVATION AND OBJECTIVE

One of the greatest issues confronting the agricultural sector in India is low yield: India's homestead yield is 30-50% lower than that of developed countries. Normal farm size, poor framework, low utilization of homestead advancements is a portion of the variables that makes the agricultural sector undeveloped other than this the significant test of agriculture is power and water supplies. So keeping in view the primary goal of our work is to screen the natural conditions i.e. soil dampness and air temperature subsequently by constantly observing this parameter the normal water supply to the fields is checked which prompts avert superfluous supply of water to fields, diminishing the utilization of energy needs.

4. PROTOTYPE

The image appeared beneath portrays the prototype of our thought. Here in the essential stage the sensors assume a critical job with the end goal to send the ongoing information of the atmospheric temperature and the moisture of the soil to the cloud server [10]. The information over the cloud checks the temperature and moisture necessity for the crop. Depending on the present esteem, if the required temperature is over the threshold temperature at that point the moisture content of the soil bit by bit decreases prompting to send a direction to the relay with the end goal to check the supply of water a part from that the data over the cloud can be retrieved by the concerned individual. The farmers likewise have remote access to the field by means of the cloud server with the assistance of which they can schedule supply water and required insecticides and pesticides to the fields time to time.

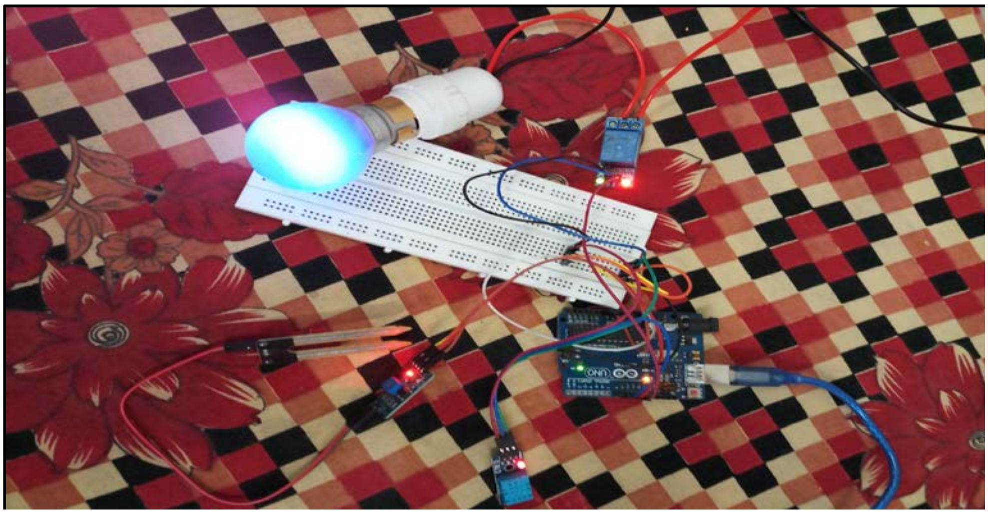


Figure 1. A figure showing prototype of the proposed idea.

5. HARDWARE AND SENSOR DESCRIPTION

5.1 Arduino – The Arduino Uno is basically microcontroller board based upon the data sheet of ATmega328. The power can be supplied to the microcontroller board by using the DC power jack (7 - 12V), the USB connector (5V), or the VIN pin of the board (7-12V) provided. Apart of that the Arduino consists of various pins i.e. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button to rest the Arduino module. It consists of all the required components in order to run the microcontroller. Apart of integrating sensors Arduino provides a wide range of application in the field of robotics, automation, control & various DIY projects.

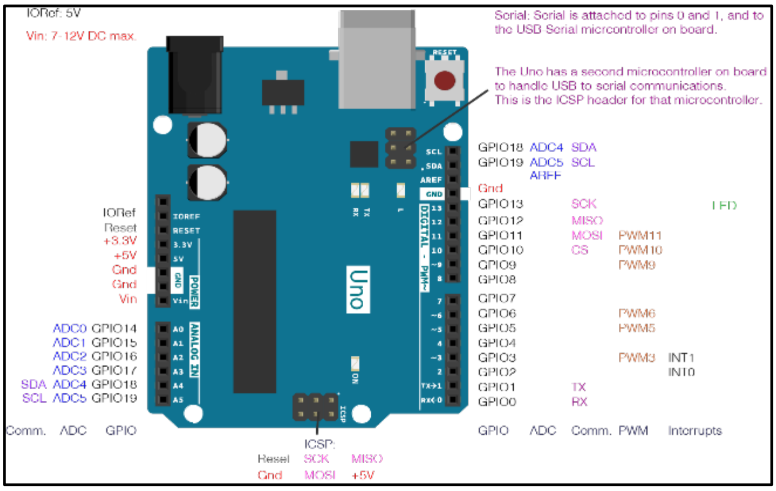


Figure 2. A picture showing layout of Arduino/Uno Module

5.2 DHT11 – DHT11 is basically a sensor module which enables us to sense the surrounding temperature & humidity. It usually comes with either 3-Pin or 4-Pin configuration where the significance of the 3 Pins are Vcc, GND & Data respectively. It has the capacity to measure 0℃-50℃ with an error of ± 2 ℃. The working of DHT11 basically deals with the thermistor which is basically a variable resistor that has the property to change its resistance with the change in temperature. In order to measure the humidity this module consists of two electrodes with moisture holding substrate between the electrodes as the atmospheric humidity changes the conductivity of the substrate [5] & hence affecting the resistance between the electrodes a part of that it consists of an IC which enables the module to get connected to the microcontroller.

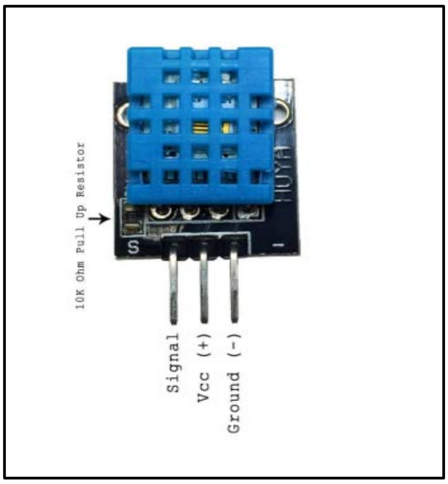


Figure 3. DHT11 sensor showing its pin configuration

5.3 YL-69 – YL-69 is associated with the soil moisture sensor whose primary work is to measure the moisture/wetness or the water content of the soil. It usually comes with 4-Pin configuration i.e. (GND, Vcc, Analog Pin & Digital Pin) mostly the working voltage of this sensor is (3.3-5) V DC. This sensor consists of two probes which are inserted into the soil this probe allows to pass the current through the soil then the moisture value is decided by the resistance value of the soil. For example, when there is more water in the soil the conductivity of the soil is more hence the resistance value will be less & moisture value is detected as high similarly for dry soil the conductivity is low so the required resistance is high & the moisture value is detected as low. We can use the threshold in order to enable the digital output at the certain moisture level using potentiometer.

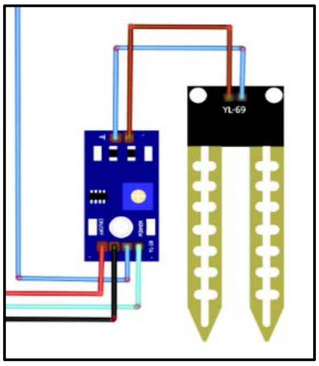


Figure 4. YL-69 Soil temperature & moisture sensor.

6. TESTBED

The testbed consists of an Arduino module, DHT11 sensor, YL-69 sensor some connecting path cords, a relay module & a night lamp depicting the pump set. Initially the Arduino module is programmed using Arduino IDE taking care of all the necessary errors the program is dumped into the Arduino module through the USB cum power adaptor. The primary supply voltage of Arduino is 5V DC. The sensors are connected with the module with the help of a breadboard and patch cords followed by the supplied voltage of the DHT11 and YL-69 sensors are 5V DC, the respective pins of the sensors are connected with the digital & analog pins of the Arduino module. A relay module is also connected with Arduino module to operate the night lamp depicting the pump. When the primary data from the sensors gets matched by the threshold data the system is healthy depicting the lamp in off state. But when the primary data is doesn't meet the threshold the lamp glows on showing that the pump set is on and the water is supplied to the fields. The data from the sensors are stored in the local server (xampp) [8] in order to monitor the condition of the fields. The data form the sensors can also be stored over the cloud enabling a more flexibility and making the system more reliable such as remote monitoring and control of the system.

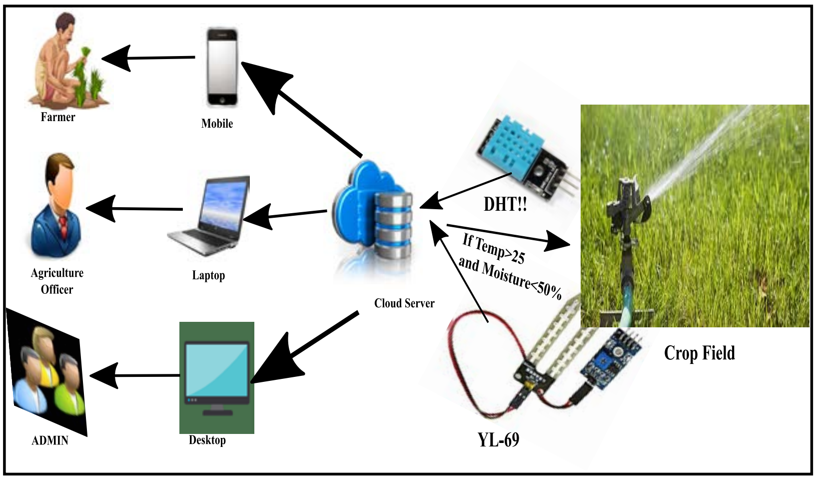


Figure 5. Testbed showing the connections of sensors with Arduino module.

7. RESULTS

The following results are obtained from the testbed showing the output of the sensors on Arduino IDE environment, local server(xampp) & also over the cloud storage.

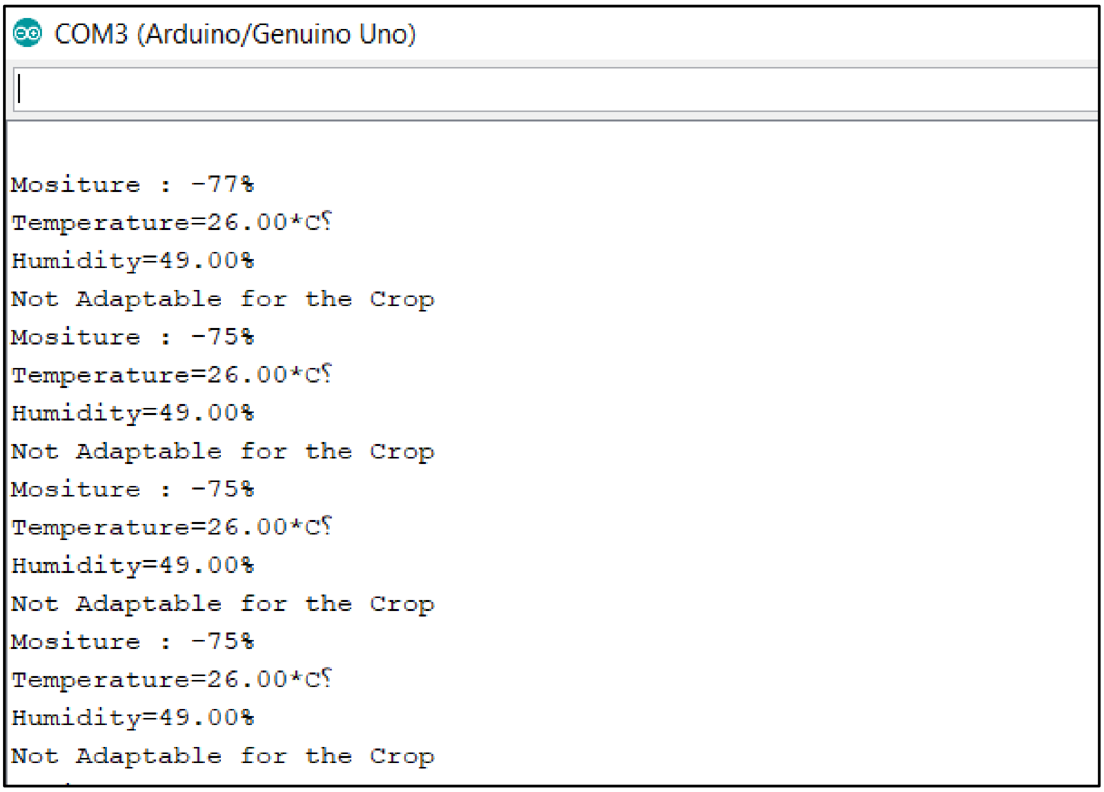
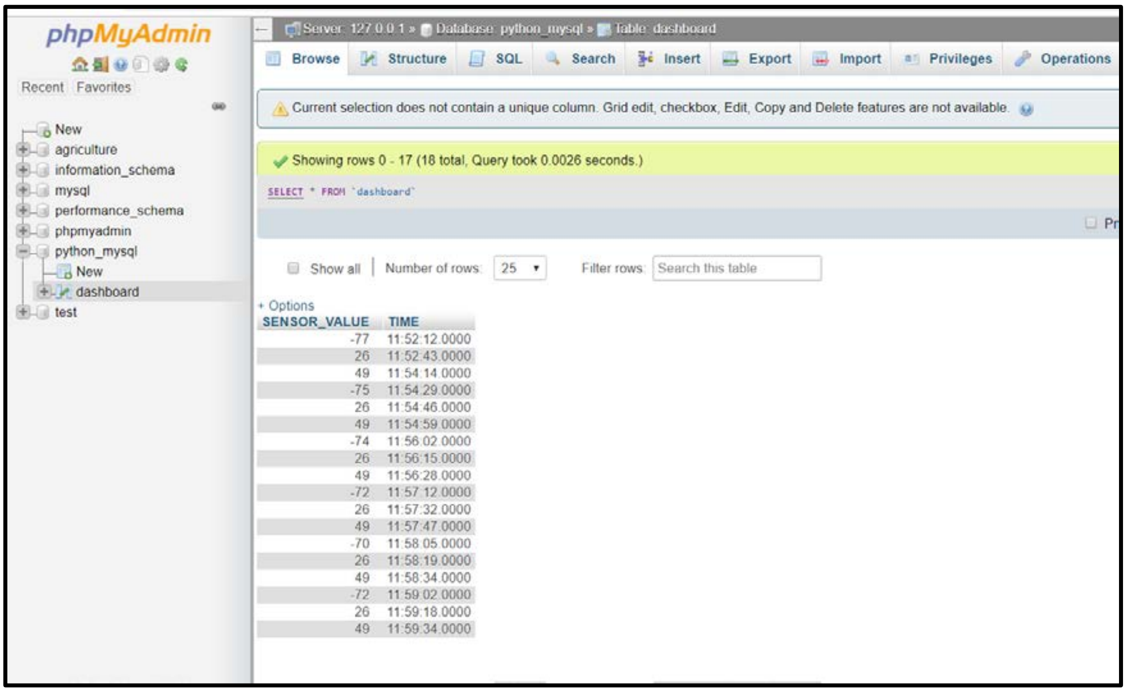


Figure 6. Output of the sensor data in Arduino IDE environment.



SENSOR_VALUE	TIME
-77	11:52:12.0000
26	11:52:43.0000
49	11:54:14.0000
-75	11:54:29.0000
26	11:54:46.0000
49	11:54:59.0000
-74	11:56:02.0000
26	11:56:15.0000
49	11:56:28.0000
-72	11:57:12.0000
26	11:57:32.0000
49	11:57:47.0000
-70	11:58:05.0000
26	11:58:19.0000
49	11:58:34.0000
-72	11:59:02.0000
26	11:59:18.0000
49	11:59:34.0000

Figure 7. Output showing the sensor values stored on XAMPP sever.

8. CONCLUSION & FUTUREWORK

Adapting IoT based technique for agriculture enhances the proficiency of cultivation by retrieving the real time data from sensor, utilising it for monitoring & enhancement in field. The issues of overabundance water application, ill-advised use of chemical fertilizers can be eluded from to constrain water use and get ideal yield. IOT not just checks the normal water requirements for the harvest yet in addition checks the ideal usage of energy required for the supply of water from pumps thus helping the farmers in enhancing the production of crops in a more efficient way. In the upcoming days this idea can be additionally incorporated to build up a successful weed management system in the crops by utilizing image processing and IOT based sensor techniques besides this can be reached out to real-time crop monitoring and automation of chemical fertilizers supply to the fields.

9. REFERENCES

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