Automatic Irrigation Using IOT And Nutrient Dispenser

Sagarika Das
Electronics and Communication Engineering
Haldia Institute Of Technology
Haldia,India

Himanshu Anand
Student,Electronics and Communication Engineering
Haldia Institute of Technology
Haldia ,India

Suchandra Das
Student,Computer Science and Engineering
KIIT University,Bhuvaneswar,India

Abstract— As agriculture is the livelihood of many Indian families and major contributor to the GDP. Many researches have shown that over and under irrigation as well as use of fertilizer affects the yield of the crop. Internet of Things has capacity to rework the lives of individuals with in the world in an efficient manner. The ever-growing population would touch more than 10 billion in few years. So, to feed such an immense population, agriculture industry needs to embrace IoT. The demand for more food has to address challenges that include excessive climate conditions, weather change and different environmental affects that results from farming practices. Our system is basically a high tech and capital-intensive system for growing crops in a sustainable manner for masses. Nitrogen is the major nutrient needed by the crops, so in this project we designed a system that calculates the amount of nitrogen deficiency from the color of the leaf, RGB value of leaf color is compared with the RGB values of leaf color chart given by the agricultural university, and the system also find the other available and deficient nutrients from the pH of soil. By using the standard parameters published by NFSM States by department of agriculture and cooperation, we have done analysis on how much quantity of nutrients should be added from the sensors data. Calculated amount of fertilizer will be dispensed through the irrigation channel. The system is completely automated using IOT.

Keywords- *IoT,pH,smart agriculture,GSM ,smart irrigation Arduino module*

I. INTRODUCTION

For most Indian families, agriculture is the most important occupation. It plays an essential role in agriculture development. The agricultural sector accounts for approximately 16 percent on average of GDP in India and 10 percent of total of all exports. Even after people's perception of the agricultural process, today's agricultural industry is more data-centric, accurate and intelligent than ever before. The rapid emergence of IOT technologies redesigned nearly every industry, which translated the industry from statistical approach to quantity approaches, includes 'Smart Agriculture'. This project aim is to help the farmers to obtain maximum amount of yield by determining the pH of the soil which helps us to determine which types of plants can be planted in the particular soil and altering the pH of the soil to plant required crops and determining temperature and humidity of the crops for the controlled yield of the crops. In the project, we determine the Nitrogen deficiency and irrigation of the crop is automated by connecting the soil moisture sensor to the motor.

As many researches have shown that over use and under use of fertilizers, has led to significant low yield of crops. And it is not easy to identify how much amount of fertilizers is needed for crops by naked eye. We need to add correct amount of fertilizers to yield expected target yield. So our project calculates deficiency of nitrogen which is most important for crops and alerts when there is deficiency of nitrogen and suggest how much fertilizers to use.

II. LITERATURE REVIEW

As many researches have shown that over use and under use of fertilizers, has led to significant low yield of crops. And it is not easy to identify how much amount of fertilizers is needed for crops by naked eye. We need to add correct amount of fertilizers to yield expected target yield. So our project calculates deficiency of nitrogen which is most important for crops and alerts when there is deficiency of nitrogen and suggest how much fertilizers to use.

The Conventional methods used chemical methods and spectroscopic methods to check available nutrients in soil. And in many methods, they have used SPAD meters to find chlorophyll content for nitrogen detection. Due to recent improvements in technology along with more efficient and accurate sensors the method of Nutrients deficiency detection and dispensing System can be carried out using combination of color recognition sensor and pH sensor. Compare to the older conventional methods our system is much cheaper and quicker.

Dr. Sanjay developed a Smart Agriculture Monitoring System Using IOT[1] by using sensors and according to the decision from a server based on sensed data, the irrigation system automated. By using wireless transmission, the sensed data forwarded towards to web server database.

Pavan Kumar Naik presented a paper on Automation of irrigation system using IOT .He used sensors for soil humidity, temperature and moisture placed in the soil surface area and forward data to androids. Soil moisture sensor threshold value which is programmed to control the amount of water into a microcontroller. The android application shows the temperature, humidity and soil moisture values. One more literature survey has shown Automatic Irrigation System by sensing soil moisture content. This literature is presented by C. Arun, K. Lakshmi Sudha [3]. The purpose of this paper is to develop a framework for computerized irrigation which switches in and out of the pouring motor to identify earth's moisture content. This paper only considers the value of the soil moisture, but the project design supported this existing project by adding temperature and humidity.

Study on an Agricultural Environment Monitoring Server System using Wireless Sensor Networks, 2010 by Jeonghwan Hwang, Changsun Shin, and Hyun Yoe.[4] , paper presents a distant irrigation system developed for the farming plantation in Arduino that is placed on the distant location and requires water to plant when the moisture content of the soil falls below the minimum function values. But in doing so, we did not know about the level of soil humidity so that this disadvantage proposed system with an additional soil humidity value and a value of the temperature on this mobile farming application was overcome.

IOT based Smart Farming System by Yasir Fahim[5], the aim of this paper is to make it possible for farmers to have live soil humidity temperatures at very cheap prices in order to perform real - time monitoring.

Parameter Monitoring for the Precision Agriculture, International Journal of the Research and Scientific Innovation, 2015 by Kiruthika M, Shweta T, Mritunjay O, Kavita S.[6] In this section the writer describes that in order to increase productivity, the intrusion detection system in the agricultural field is necessary. In the modern agricultural scenario, particularly in India, the author also explains the need for precise agriculture. This paper[6] shows how natural habitats are evaluated and supervised.

Nutrient Detection for Maize Plant using Non-invasive Technique by Shraddha B H , R.M.Shet, Nikita P, Nalini C Iyer paper[7]. The thought discusses the nitrogen and phosphorus content assessment in leaves using a separate spatial filtering. Various readings are used for nitrogen identification using multiple ways, such as visible and infrared, and results have been studied. The sensor provided a lot of lectures compared to traditional of spectroscopy.

Detection of Nitrogen, Phosphorus, and Potassium (NPK) nutrients of soil using Optical Transducer by Marianah Masrie, Mohamad Syamim Aizuddin Rosman, Rosidah Sam and Zuriati Janin.[8] This article is used to design and develop a substitute method to identify shortfalls N, P, or K in the soil, using the optical transducer, LEDs, and photodiode with the Arduino microcontroller.

Smart Agriculture: IOT based smart sensors agriculture by Anand Nayyar and Er. Vikram Puri, November 2016.[9] They have designed an integrated machine agriculture system in this article that decreases the time and resources needed to conduct it manually. This process utilizes Concept of Internet of things. The sensor monitors soil moisture and water level in fields too though.

Smart Agriculture and Irrigation Monitoring System using IOT by Avhad Priti, Avhad Pooja, Hande Madhuri, Matkar Kamal.[10] In this article, they have introduced a new technique to smart agriculture by connecting a smart monitoring system to an intelligent irrigator system via WiFi

III. HARDWARE AND SOFTWARE USED

A. Arduino is an open-source hardware and software company, initiative, and user community that creates single-board microcontrollers and microcontroller kits for creating digital devices.

B. A relay is an electro-mechanical device that disconnects electrical connection. It consists of a flexible moving mechanical portion that can be controlled electrically using an electromagnet; in other words, a relay is similar to a mechanical switch, but instead of physically turning it on or off, you may control it with an electronic signal.

C. The DHT11 is a low-cost, low-level digital temperature and humidity sensor. It measures the ambient air with a capacitive humidity sensor and a thermistor and outputs a digital signal on the data pin. It is simple to use, but it necessitates precise timing in order to capture data at the needed interval. We can acquire new info from it every 2 seconds on average. The DHT11 sensor is utilised in a variety of applications. such as measuring of humidity and temperature values in heating, ventilation and air conditioning systems. Mainly weather stations use these sensors to predict conditions of weather.

This sensor includes a dedicated NTC for temperature measurement and an 8-bit microprocessor for serial data output of temperature and humidity values. This sensor is also calibrated, allowing it to communicate with other microcontrollers. With an accuracy of 1°C and 1%, this sensor can measure temperature from 0°C to 50°C and humidity from 20% to 90% with an accuracy of 1°C and 1%. We are also involved in our project.

D. Two Soil moisture sensors are used to measure the volumetric water content for the solar moisture sensor. The two samples allow the current to go

E. The pH scale is used for acidity and fluid fundamentals measurement. It can contain 1-14 readings with 1 showing the most acidic fluid and 14 showing the most basic fluid. pH 7 is not really for acidic and basic neutral substances.

F. Thumbnails scale Micro dipped pump DC 3-6V Mini Water Syphon Mini Flow System DIY venture for Fountain Garden. The small size Submersible Pump engine is a minimal effort which can be manipulated by a 3~6V control supply. With an extremely low current usage of 220mA, it can take up to 120 litres per hour. Just plunge and power the tube tube pipes into the engine outlet. Ensure a constantly higher water level than the motor. Dry running may damage the engine due to warming and creates a clamour as well[11].

G. TCS3200 Colour Recognition Sensor is a tiny module that converts light intensity to frequency. The module has four white LEDs in addition to the TAOS TCS3200 RGB sensor chip. The TCS3200 is capable of detecting and measuring a nearly infinite number The colours are observable. Includes reagent kit reading, colour filtering, illumination sensing and calculation, and colour correspondence, to identify just some. The TCS3200 has a variety of photo detectors with a red, green, blue or no filter (clear). The scanners of each colour are evenly distributed across the array to remove the position distortion between the shades. Interior to the device is an oscillator that produces a square-wave output that is proportional in frequency to the amplitude of the shade.

H. This GSM/GPRS cable telephone is a quad band that operates with frequencies of 850/900/1800/1900 MHz that can be used not only for Access to internet and for voice (where a small voice and mic speaker are connected) and SMS communication.

I. The "Arduino IDE"[12] is a free and open-source programme. It offers a user-friendly interface that makes writing, compiling, and verifying code as well as dumping it to the board simple. It is compatible with Linux, Windows, and Mac OS X. The software's interface and the majority of its libraries are developed in Java, and it supports a wide range of open source libraries. The Arduino IDE is a cross-platform development environment that may be used with any Arduino microcontroller. This IDE supports a wide range of Arduino boards, including the Uno, Nano, Mega, Esplora, Ethernet, Fio, Pro or Pro Mini, LilyPad Arduino, and many others[13][14].

IV. BLOCKDIAGRAM AND IMPLEMENTATION

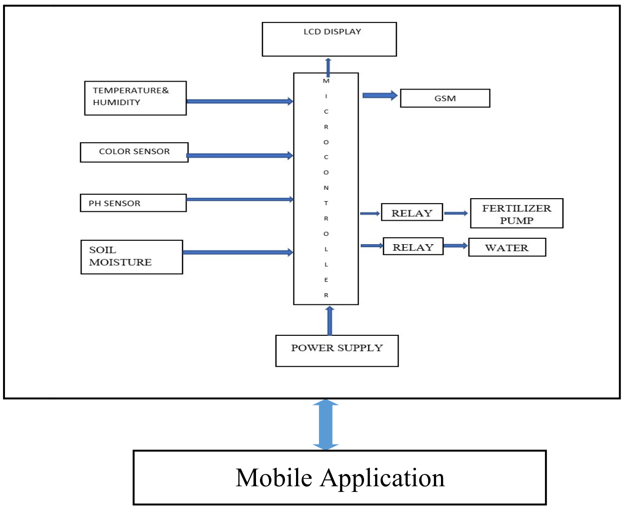


Figure1. Block diagram of Smart Irrigation

The details block diagram is shown in figure 1.As soon as power supply of Arduino module is activated ,all peripherals will get activated. Measured value will be displayed on LCD unit. When the soil moisture value reached below threshold temperature, through relay pump will turn on to dispense water to maintain adequate temperature of soil. Color recognition sensor will measure the RGB values of crop leaves and compares it with RGB values of leaf color chart given by Agriculture University. And it measures nitrogen deficiency, if deficiency is found it sends voice alerts to farmers app. All the sensors data will send to webpage also. After getting information from sensor farmer can turn on fertilizer pump through app[15][16].

The flow chart describes in Figure 2 ,that when the power is given to the system, all sensors get initiated and they measure data. The measured data is displayed in LCD and also sent to Farmers app. With the help of color strip we can able to find the quantity of nitrogen present on plant based on leaf color chart of particular plant

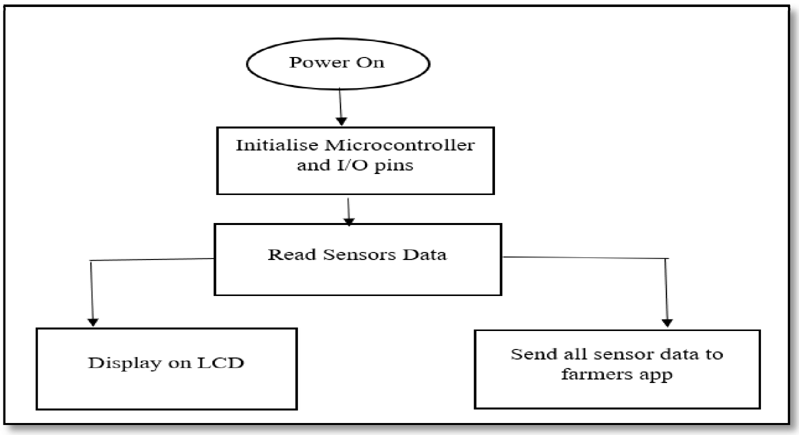


Figure2 . Flowchart of overall implementation

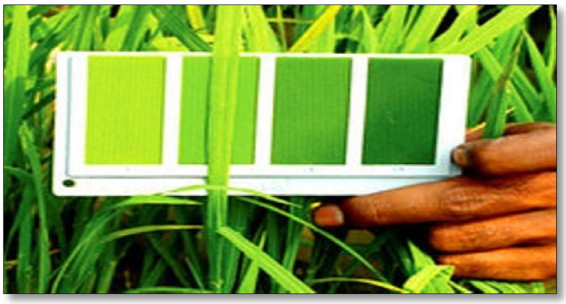


Figure.3 Leaf Color strip for Maize crop

Leaf Color	RGB Value	% N Deficiency
	R=0 G=255 B=0	60%
	R=0 G=230 B=0	40%
	R=0 G=180 B=0	5%
	R=0 G=128 B=0	Sufficient Nitrogen Available

Leaf Color	RGB Value	% N Deficiency
	R=0 G=230 B=0	50%
	R=0 G=200 B=0	30%
	R=0 G=160 B=0	10%
	R=0 G=115 B=0	Sufficient Nitrogen Available

VI.RESULT ANALYSIS

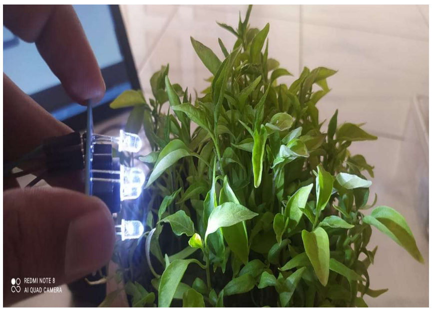


Figure 3. Checking Greenness Value of Crop using color recognition sensor

Figure 4.Display is showing status of Nitrogen on soil

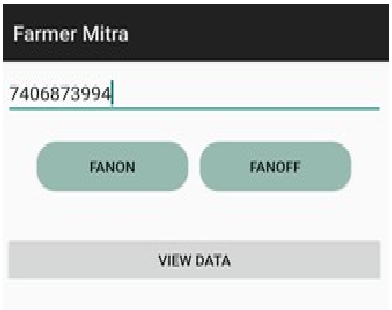


Figure 5. The above figure describes how the turning ON and OFF of fertilizer pump through an Android app

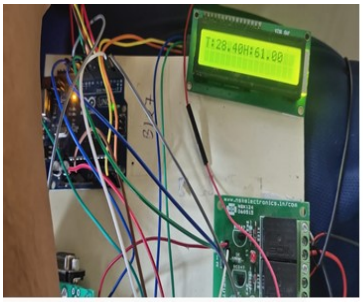


Figure 6. The above figure shows the measuring of the temperature and humidity of the environment.

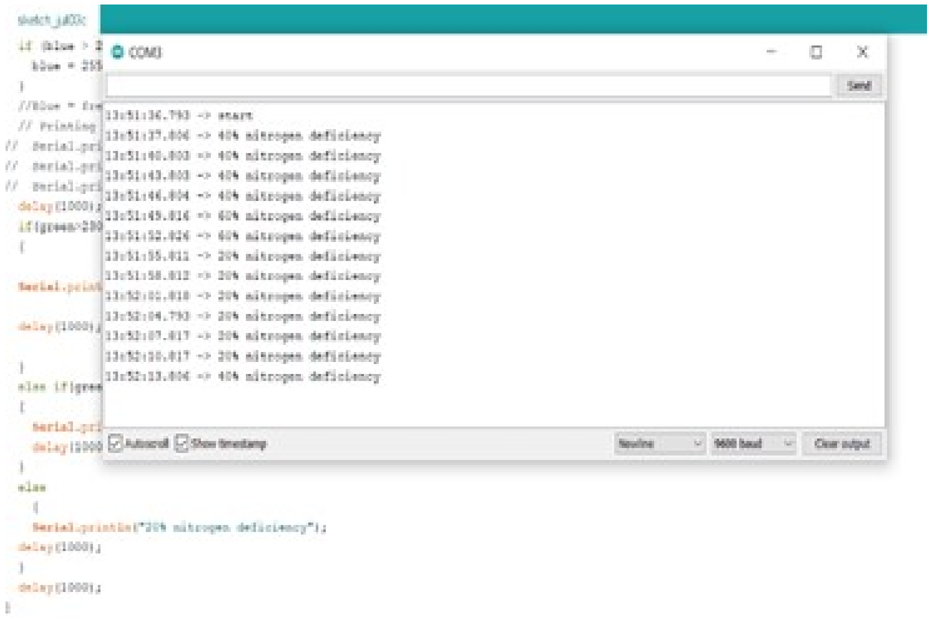
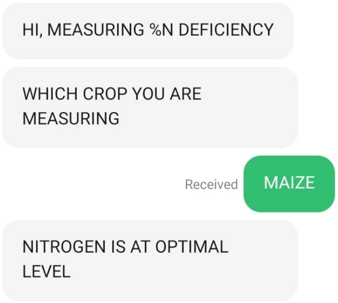
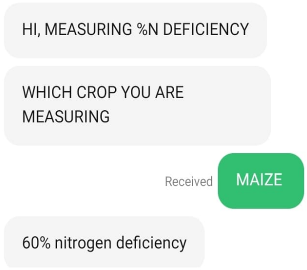


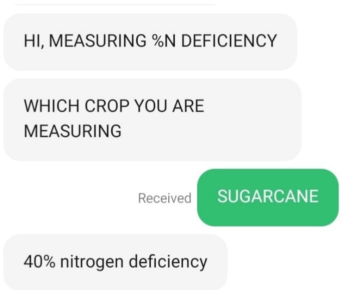
Figure 7. The above figure defines how the deficiencies for different color of leaves the color recognition detects

Figure 8. The above figure shows the measuring pH of the soil for a Crop





(a) (b)



(c)

Figure 9. (a), (b), (c) shows nitrogen deficiency for Maize and Sugarcane using GSM

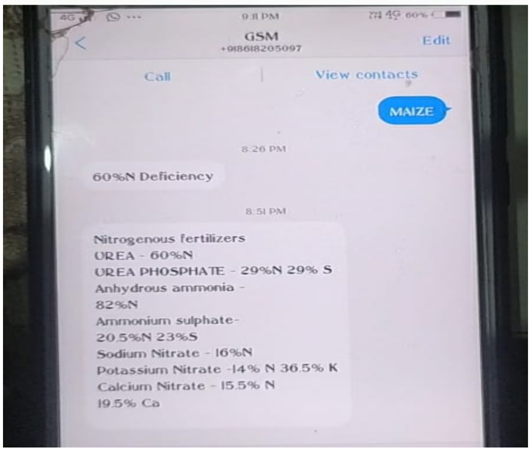


Figure 10. The above figure shows the GSM communication with farmer mobile through SMS which suggests the nitrogenous fertilizers required to add to crop

V. CONCLUSION

- By implementing our project in field, the farmer will be able to increase the crop production and soil fertility.
- The farmer will be able to, irrigate and fertilize the field at the same time with right quantity of water and fertilizers.
- With the use of our project which is a automated system helps non-technical farmer monitor the parameters through lcd display
- The farmer will be able to get alerts to his/her handset which helps him/her to be tension free if the any changes occur in the field environment.
- By implementing our project in field, farmer will be able to manage multiple crops by changing the actual parameters which makes our project irreplaceable.

REFERENCES

[1]. S. N. Patil , M. B. Jadhav," Smart Agriculture Monitoring System Using IOT," IJARCCE, Vol. 8, Issue 4, April 2019

[2]. P.Naik,"Automation Of Irrigation System Using IoT," International Journal of Engineering and Manufacturing Science. ISSN 2249-3115 Volume 8, Number 1 (2018) pp. 77-88 © Research India Publications.

[3]. C. Arun, K. Lakshmi Sudha ,"Agricultural Management using Wireless Sensor Networks – A Survey", 2nd International Conference on Environment Science and Biotechnology IPCBEE vol.48 ,2012IACSIT Press, Singapore 2012.

[4] J.Hwang , C.Shin , H.Yoe , "Study on an agricultural environment monitoring server system using Wireless Sensor Networks," MDPI doi: 10.3390/s101211189.

[5]. Y. Fahim," IOT based Smart Farming System" . ISSN 5593-9574 Volume 8, Number 1 (2018) pp. 77-88 © Research India Publications.

[6]. M.Kiruthika , T. Shweta ,O. Mritunjay , S.Kavita ," Parameter Monitoring for the Precision Agriculture", International Journal of the Research and Scientific Innovation 2015.

[7]. M. T., Voroney, P. and Parkin, G. 2005," Predicting nitrogen fertilizer requirements for corn by chlorophyll meter under different N availability conditions". Can. J. Soil Sci. 85: 149159

[8].W.B. McGill and C. T. Figueredo." Soil sampling and methods of analysis". Lewis Publishers Inc., PP 201-212, 1993

[9].S.C. Chapman, andJ.H. Barreto, "Using a chlorophyll meter to estimate specific leaf nitrogen of tropical maize during vegetative growth". 1st July,1997.https://doi.org/10.2134/agronj1997.00021962008900040000.

[10]. B.Doeaswamy, "Automatic Irrigation System Using Arduino Controller", International Journal of Advanced and Innovative Research, ISSN 2348-2370, Vol.08, Issue, 04, April-2016, Pages: 0635–0642

[11]. D.Rane, Prof. P. R. Indurkar, Prof. D. M. Khatri, "Review Paper Based On Automatic Irrigation System Based On Rf Module," Volume 1, Issue 9, January 2015 ISSN 2348 – 9928,

[12]. A. Kumar, M.S, "Automated Irrigation System Based On Soil Moisture Using Arduino, International Journal of Pure and Applied Mathematics, ," Volume 116 No. 21 2017, 319-323, ISSN: 1314-3395

[13]. S.J.Muneeswari, M. Janet ,E. Rajeshwari, G.Selvarani," Smart Irrigation System Using Iot Approach", International Journal of Engineering Research & Science ,Vol-3, Issue-3 March- 2017

[14]. A.Tyagi, N.Gupta, J. P. Navani, R.Tiwari ,"Smart Irrigation Sysyem" IJIRST- Internation Journal for Innovative Research in Science and Technology, Volume 3/Issue 10/March 2017;ISSN (online): 2349–6010

[15]. C.Sahu, P. Behera," A Low Cost Smart Irrigation Control System" IEEE Sponsored 2nd International Conference on Electronics And Communication System (ICECS 2015).

[16]. C. Nivedha, S. Rovina .J .Auxilia, M. Vaitheeswari, M. Murugalingam," Comparative Study Between Automatic Irrigation System using Soil Moisture Sensor and Conventional Flooding Method of Irrigation"Intrnational Journal of Innovative Research in Science, Engineering and Technology; An ISO 3297:2007 Certified Organization; Volume 7, Special Issue 5, April 2018. ISSN (Online): 2319-8753, ISSN (Print): 2347–6710.