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Original Article

Maximizing Agriculture Yield Using UV Ray and IoT

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Abstract: *Agriculture is a major part of our lives as human beings. A lot of research has been carried out in order to be able to develop a monitored and controlled greenhouse system/environment that will help in solving the main problems relating to agriculture which is to enable the increase in the crops being cultivated all year round in the comfort of a small space like the home, and also to reduce human interaction in a small scale greenhouse environment. So accordingly, an automated greenhouse monitoring and control system is proposed with UV calibration feature for the sole purpose stated above. In this project, we are interfacing UV Sensor ML8511 with Arduino for measuring Ultra Violet Light Intensity in mW/cm^2. We will interface UV Sensor ML8511 with Arduino & LCD or OLED Display. UV Radiation or Ultraviolet light radiation occurs from 10nm to 400nm wavelength in the electromagnetic spectrum. So in order to get effective output in accordance with UV light the GY/ML8511 sensor from lapis semiconductor helps a lot. The ML8511 UV sensor detects 280nm – 390nm light in a better way, this wavelength is categorized as part of the UVB-burning rays' spectrum and most of the UVA-tanning ray's spectrum. Based on the stages of plant, the UV environment is created using lamps. The system was built using a number of connection wires, sensors, LCD, a cooling system, a power bank, LEDs, LDRs, Arduino board among a few other components. The result obtained was a fully functioning system that was set to monitor the greenhouse environment.*

Keywords: *Agriculture, LCD. OLED Display, Arduino. UV Ray, IoT.*

I. INTRODUCTION

Smart agriculture is a farming management strategy based on observing, measuring and responding to temporal and spatial variability to improve agricultural production sustainability.[2] It is used in both crop and livestock production. Smart agriculture often employs technologies to automate agricultural operations, improving their diagnosis, decision-making or performing.[3][4] First conceptual work on PA and practical applications go back in the late 1980s.[5] The goal of smart agriculture research is to define a decision support system (DSS) for whole farm management with the goal of optimizing returns on inputs while preserving resources.

Among these many approaches is a phytogeomorphological approach which ties multi-year crop growth stability/characteristics to topological terrain attributes. The interest in the phytogeomorphological approach stems from the fact that the geomorphology component typically dictates the hydrology of the farm field.

The practice of smart agriculture has been enabled by the advent of GPS and GNSS. The farmer's and/or researcher's ability to locate their precise position in a field allows for the creation of maps of the spatial variability of as many variables as can be measured (e.g. crop yield, terrain features/topography, organic matter content, moisture levels, nitrogen levels, pH, EC, Mg, K, and others).[10] Similar data is collected by sensor arrays mounted on GPS-equipped combine harvesters. These arrays consist of real-time sensors that measure everything from chlorophyll levels to plant water status, along with multispectral imagery.[11] This data is used in conjunction with satellite imagery by variable rate technology (VRT) including seeders, sprayers, etc. to optimally distribute resources. However, recent technological advances have enabled the use of real-time sensors directly in soil, which can wirelessly transmit data without the need of human presence.[12][13]

Smart agriculture has also been enabled by unmanned aerial vehicles that are relatively inexpensive and can be operated by novice pilots. These agricultural drones can be equipped with multispectral or RGB cameras to capture many images of a field that can be stitched together using photogrammetric methods to create orthophotos. These multispectral images contain multiple values per pixel in addition to the traditional red, green blue values such as near infrared and red-edge spectrum values used to process and analyze vegetative indexes such as NDVI maps.[14] These drones are capable of capturing imagery and providing additional geographical references such as elevation, which allows software to perform map algebra functions to build precise topography maps. These topographic maps can be used to correlate crop health with topography, the results of which can be used to optimize crop inputs such as water, fertilizer or chemicals such as herbicides and growth regulators through variable rate applications.

Smart agriculture is a key component of the third wave of modern agricultural revolutions. The first agricultural revolution was the increase of mechanized agriculture, from 1900 to 1930. Each farmer produced enough food to feed about 26 people during this time.[15] The 1960s prompted the Green Revolution with new methods of genetic modification, which led to each farmer feeding about 156 people.[15] It is expected that by 2050, the global population will reach about 9.6 billion, and food production must effectively double from current levels in order to feed every mouth. With new technological advancements in the agricultural revolution of smart farming, each farmer will be able to feed 265 people on the same acreage.

Prescriptive planting is a type of farming system that delivers data-driven planting advice that can determine variable planting rates to accommodate varying conditions across a single field, in order to maximize yield. It has been described as "Big Data on the farm." Monsanto, DuPont and others are launching this technology in the US.

II. LITERATURE REVIEW

Srilikhitha et al automates the irrigation process thereby reducing the manual intervention and the water losses. It is more helpful in the places where water scarcity is seen more. It consists of 2 sensors which takes the values of temperature of surroundings and moisture level of soil.

K. Sreeram et al provides a solution for these problems by helping farmer monitor and control various activities through his mobile via GSM and DTMF technology in which data is transmitted from various sensors placed in the agricultural field to the controller and the status of the agricultural parameters are notified to the farmer using which he can take decisions accordingly.

Deepali Kothari et al attempt to implement automation for control of electrical motor or pump used in agriculture domain. The agriculture work by its nature is a field job; hence devices used are sparsely distributed. This makes it difficult for farmers to control and operate these devices in real time.

M. O. Sharma ; P. M. Sonwane propose android based agricultural support system, that is, automatic irrigation system which adjusts the quantity of water based on sensor data. Monitoring and control of water irrigation and level detector with liquid fertilizer is being proposed in dissertation work with different control schemes and monitoring methods implemented using the micro-controller 89S52 and PIC 18F4550.

A. Ruby Roselin et al proposed project is to making agriculture smart using IoT technologies. The important feature of this project includes the prevention of crops from spoilage during rain and efficiently recycling the rain water for irrigation. Secondly, it includes intruder alarm/buzzer which is used to detect any human/animal intruder into the farm.

Ateeq Ur Rehman et al proposed design also has the feature of GSM which makes this system wireless. The electricity required by components is provided through solar panels hence this liberates us from interrupted power supply due to load shedding. The water content is constantly judged and whenever moisture level of soil gets low, the system sends a signal to motors asking them to turn on.

G Kavianand et al presents a fully automated drip irrigation system which is controlled and monitored by using ARM9 processor. PH content and the nitrogen content of the soil are frequently monitored. For the purpose of monitoring and controlling, GSM module is implemented. The system informs user about any abnormal conditions like less moisture content and temperature rise, even concentration of CO_2 via SMS through the GSM module.

K. S. Vijula Grace et al proposed work describes the automated system to make effective utilization of water resources for agriculture and crop growth monitoring using GSM. The effective utilization of drip irrigation process is improved by using the signals obtained from soil moisture sensor. The output signals of the sensors are coordinated by the microcontroller and transmitted to the user with the help of GSM Modem.

Ashok Jhunjhunwala et al presents a new approach to building an Agricultural Advisory System aimed at bridging the information gaps that exist between farmers and extension workers and agricultural scientists in a country like India. It demonstrates the power of two-way mobile phones today, which when combined with innovative methods could provide services to farmers that could not even be envisaged till yesterday.

III.PROPOSED SYSTEM

A smart agriculture through embedded systems not only monitors intelligently but also controls the water. Thereby eliminating any need for human intervention. Different sensors that measure the environmental parameters according to the plant requirement are used for controlling the environment. Then, a cloud server creates for remotely accessing the system when it connects using Bluetooth technology. Based on UV, the atmosphere level are controlled through the lamp

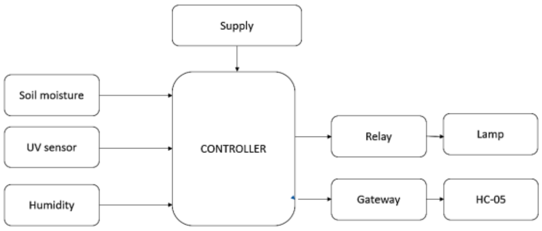

Figure 1: Proposed System

A. UV Sensor ML8511

Figure 2: UV Sensor ML8511

The ML8511 UV sensor is easy to use the ultraviolet light sensor. The MP8511 UV (ultraviolet) Sensor works by outputting an analog signal in relation to the amount of UV light that's detected. This breakout can be very handy in creating devices that warn the user of sunburn or detect the UV index as it relates to weather conditions.

This sensor detects **280-390nm** light most effectively. This is categorized as part of the UVB (burning rays) spectrum and most of the UVA (tanning rays) spectrum. It outputs an analog voltage that is linearly related to the measured **UV intensity (mW/cm2)**.

B. SX1278 LoRa Module

The SX1276/77/78/79 transceivers feature the LoRa® long range modem that provides ultra-long range spread spectrum communication and high interference immunity whilst minimizing current consumption.

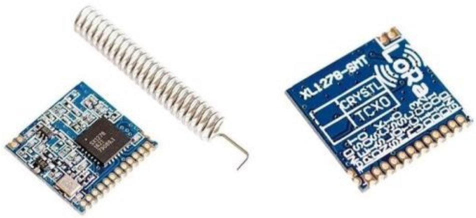

Figure 3: SX1278 LoRa Module

SX1278 can achieve a sensitivity of over -148dBm using a low-cost crystal. The high sensitivity combined with the integrated +20dBm power amplifier yields industry leading link budget making it optimal for any application requiring range or robustness. Lora SX1278 also provides significant advantages in both blocking and selectivity over conventional modulation techniques, solving the traditional design compromise between range, interference immunity and energy consumption.

MOSI to D11, MISO to D12, SCK to D13, D10 for NSS and D9 for the Reset. But there are modifications done on switching side. In the transmitter section two tactile buttons are connected to D3 and D4 pin of the Arduino. Buttons are worked in hold state only. The output at receiver end goes ON/OFF by pressing/releasing tactile button respectively.

On the receiver end we are using a string receiver LED on pin D3, which gives the information about connection. This LED will blink after every second and gives the information about the successful connection of LoRa RF signal. We are using D4 and D5 as the output; by default these pins are hold high and go to low as the button pressed from the transmitter.

Arduino is an open-source computer hardware and software company, project and user community that designs and manufactures microcontroller-based kits for building digital devices and interactive objects that can sense and control objects in the physical world.

The project is based on microcontroller board designs, manufactured by several vendors, using various microcontrollers. These systems provide sets of digital and analog I/O pins that can be interfaced to various expansion boards ("shields") and other circuits. The boards feature serial communications interfaces, including USB on some models, for loading programs from personal computers. For programming the microcontrollers, the Arduino project provides an integrated development environment (IDE) based on the Processing project, which includes support for the and C++ programming languages.

C. Humidity Sensor

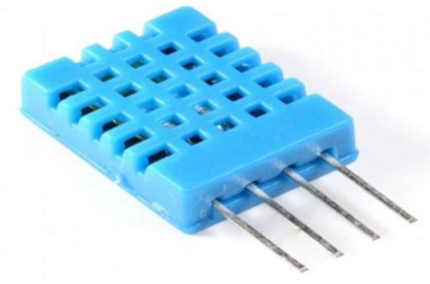

Figure 4: DH11 Temperature Sensor

This DHT11 Temperature and Humidity Sensor include an aligned advanced flag output with the temperature and mugginess sensor ability. It is incorporated with an elite 8-bit microcontroller. Its innovation guarantees the high dependability and magnificent long haul steadiness. This sensor incorporates a resistive component and a sensor for wet NTC temperature estimating gadgets. It has great quality, quick reaction, hostile to impedance capacity and high performance.

D. Arduino HC-05 HC05 Wireless Bluetooth Serial Port TX RX Module

Figure 5: Arduino HC-05 HC05 Wireless Bluetooth Serial Port TX RX Module

The HC-05 is based on the EGBT-045MS Bluetooth module. It can operate as either a slave device or a master device. As a slave it can only accept connections. As a master it can initiate a connection.

The EGBT-045MS Bluetooth module (the smaller daughter board) is a 3.3v device. The HC-05 break out board has a 3.3v regulator that allows an input voltage of 3.6v to 6v but the TX and RX pins are still 3.3v. This means you can use the 5V out from the Arduino to power the boards but you cannot connect the Arduino directly to the HC-05 RX pin.

For the HC-05 RX pin (data in) we need to convert the Arduinos 5V to 3.3v. A simple way to do this is by using a voltage divider made from a couple of resistors. In my case I use a 1K ohm resistor and a 2K ohm resistor. As a quick guide to the voltage divider; 1K + 2K = 3K. 1K is a third of 3K so it reduces the voltage by a third. One third of 5V is 1.66 and 5-1.66 = 3.33 which is what we want. Putting the resistors the other way would reduce the voltage by 2 thirds.

For more information on voltage dividers have a look at the Spark fun tutorial

Since the Arduino will accept 3.3 volts as HIGH you can connect the HC-05 TX pin (data out) directly to the Arduino RX pin (The 5V Arduino takes a voltage of 3V or more as HIGH).

Specification:

Model: HC-05
Input Voltage: DC 5V
Communication Method: Serial Communication
Master and slave mode can be switched
Transmission distance: 20 ~ 30m in free space

E. Conductivity Sensor

The conductivity sensor is one kind of sensor used to gauge the volumetric content of water within the surface. These sensors measure the volumetric water content not directly with the help of some other rules of soil like dielectric constant, electrical resistance, otherwise interaction with neutrons, and replacement of the moisture content.

Figure 6: Soil-Moisture-Sensor-Device

These sensors normally used to check volumetric water content, and another group of sensors calculates a new property of moisture within surface named water potential.

F. Conductivity Sensor Pin Configuration

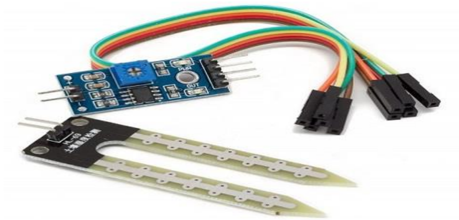

Figure 7: The FC-28 Sensor Includes 4-Pins

Soil-Moisture-Sensor

- VCC pin is used for power
- Ao pin is an analog output
- Do pin is a digital output
- GND pin is a Ground

This module also includes a potentiometer that will fix the threshold value, & the value can be evaluated by the comparator-LM393. The LED will turn on/off based on the threshold value.

IV. CONCLUSION

The application of agriculture networking technology is need of the modern agricultural development, but also an important symbol of the future level of agricultural development; it will be the future direction of agricultural development. After building the agricultural crop recommendation system hardware and analysing and researching the network hierarchy features, functionality and the corresponding software architecture of smart agriculture leaf disease systems, actually applying the intelligence to the highly effective and safe agricultural production has a significant impact on ensuring the efficient use of resources as well as ensuring the efficiency and stability of the agricultural production.

V. References

[1] Siuli Roy, Somprakash Bandyopadhyay, "A Test-bed on Real-time Monitoring of Agricultural Parameters using Wireless Sensor Networks for Smart Agriculture"

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

[3] Anurag D, Siuli Roy and Somprakash Bandyopadhyay, "Agro-Sense: Precision

[4] Agriculture using Sensor-based Wireless Mesh Networks", ITU-T "Innovation in NGN", Kaleidoscope Conference, Geneva 12-13 May 2008.

[5] Yiming Zhou, Xianglong Yang, Liren Wang, Yibin Ying, A wireless design of low-cost irrigation system using ZigBee technology, 2009 International Conference on Networks Security, Wireless Communications and Trusted Computing, 978-0-7695-3610-1/09 , IEEE.

[6] Ning Wang, Naiqian Zhang, Maohua Wang, "Wireless sensors in agriculture and food industry—Recent development and future perspective", published in Computers and Electronics in Agriculture 50 (2006) 1–14.

[7] Izzatdin Abdul Aziz, Mohd Hilmi Hasan, Mohd Jimmy Ismail, Mazlina Mehat, Nazleeni Samiha Haron, "Remote Monitoring in Agricultural Greenhouse Using Wireless Sensor and Short Message Service (SMS)", 2008.

[8] Jeonghwan Hwang, Changsun Shin, and Hyun Yoe "Study on an Agricultural Environment Monitoring Server System using Wireless Sensor Networks",2010.

[9] Zhang xihai, Zhang changli Fang junlong. Smart Sensor Nodes for Wireless Soil Temperature Monitoring Systems in Smart Agriculture 2009. 237-241

[10] Bogena H R, Huisman J A, OberdÊrster C, et al. Evaluation of a low cost soil water content sensor for wireless network applications [J].Journal of Hydrology, 2007, 32-42

[11] Weizheng, S., Yachun W., Zhanliang C., and Hongda W.," Grading Method of Leaf Spot Disease Based on Image Processing" International Conference on Computer Science and Software Engineering - Volume 06 ,PP. 491-494,December 2008.

[12] S. S. Sannakki, V. S. Rajpurohit, V. B. Nargund,and P. Kulkarni, "Diagnosis and Classification of Grape Leaf Diseases using Neural Networks", IEEE 4th ICCCNT, 2013.

[13] P. Chaudhary, A. K. Chaudhari, Dr. A. N. Cheeran and S.Godara, "Color Transform Based Approach for Disease Spot" International Journal of Computer Science and Telecommunications Volume 3, Issue 6, pp.65-70,June 2012

[14] H. Al-Hiary, S. Bani-Ahmad, M. Reyalat, M. Braik and Z. ALRahamneh, "Fast and Accurate Detection and Classification of Plant Diseases", IJCA, Vol-17,No.-1,pp. 31-38, March 2011.

[15] P. Babu, M. S. and Srinivasa Rao, "Leaves recognition using backpropagation neural network - advice for pest and disease control on crops". Technical report, Department of Computer Science & Systems Engineering, Andhra University, India, www.indiakisan.net on May 2010.

[16] Suman T. and Dhruvakumar T., "Classification of paddy leaf diseases using shape and color features", IJEEE, Volume 07, Issue 01, PP.239- 250, Jan- June 2015.