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Modular Multi Node Sensor Based Precision Farming for the Improved Performance of Crops

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Abstract: - In recent years, wireless sensor network (WSN) is frequently used in many applicatios such as monitoring of water quality, monitoring of air, and farming. In the WSN system, all the nodes are connected together by wireless communication. All the devices can be disciplined and controlled over the network by using Internet of Things (IOT). So,Combining WSN and IOT is a excellent method to build a better precision farming or agriculture. The Indonesia is an farming country and it uses modern technology to support smart farming or precision agriculture system to monitor, control and to increase agriculture production. Many innovative works are done to build a precision farming such as introduction of WSN in smart irrigation systems, robot based farming using Arduino UNO , multi- node sensor for precision farming, etc. In this research, the multi-node sensor is used depending upon the state of land farming. The challenging aim of this paper is about connecteing a multi-node sensor together with wireless network and building a cloud server to function data storage. Basically the system is divided into seven node sensors, which is again seperated into three different groups such as land node, environment node, and actuator node. Each node consists of multi- sensor, a controller and wireless module. The Aurdino UNO board and and wireless module is used in master station. The wireless network based Zigbee protocol is used for Communication between the master station and all the sensor nodes. Depending upon the threshold value of the critical sensor the system is operated in the closed loop.

Keywords: Wireless Node Sensor(WSN), multi node sensor, IOT(Internet of Things), precision farming.

I. INTRODUCTION

Now a days, the farming area is facing hard challenges due to advanced technical transformations used for enhancing the productivity and products quality. Because of rapid change of state in agricultural product use, farmers and reputed companies working together in the feld of “Big Data” to invest in precision farming by using satellites, wireless sensor networks, modern drones, and GPS tracking systems. The plants and fields are extremely sensitive to climate change conditions such as high temperatures and variations in the weather condition area will increase the chance of crop diseases, leading to crop harm and even permanent end of crops. The Current advance in Internet of things (IOT) and Cloud Computing have led to the evolution of new applications based on highly modern and scalable company level. The IOT solutions have outstanding possibility in assuring the ultimate quality and safety of farming products. The precision farming telemonitoring system design and operation of is mainly supported on the utilization of IOT platforms and therefore, this research paper briefly presents the main IOT platforms used in smart agriculture, highlights their main merits and demerits at the same time. This statement can be used as a basic reason for choosing an IOT platform answer for future telemonitoring systems. Generally all the networks are configured with networks such as local area networks. All the devices are interconnected in a network using important technology called IOT. Many problems in farming or cultivation can be avoided by combining WSN and IOT.

II. EXISTING SYSTEM

In real world WSN is used to give decision support environment. In his research paper he covered crop monitoring, decision making and detection of problems in farming. The author concerntrared on real time problems. By this technique yield of crops can be increased. This approach tell us real time condition of crops by using IOT and WSN [1]. The production can be increased by communication technology and advanced information technologies. The author used AI (Artificial intelligence) for smart farming along with robotics and sensors [2]. The author used equipment which are intelligent and of low cost. With the help of machine learning and IOT the cultivation is done in smart way. There is no need of human intervention in smat farming [3]. The green house enviroment one more interesting and challenging task. The author explained about green house environment and management in paper [4]. A very low power IOT network with some sensors is used for smart cultivation [5]. To enhance food production and to improve farming emerging smart sensors are used [6]. A modified WSN along with IOT is used in precise

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cultivation for good crop monitoring [7]. An Intelligent irrigation method with drip is used to improve production of food [8]. In smart farming using IOT the system will send message about temperature, humidity and water level to the farmers and the farmers can lively monitor the crops [9]. Smart irrigation is based on smart devices such as Micro controllers and sensors. In this paper the author used Unmanned Aerial Vehicles (UAV) and robots for spraying fertiliers and seeds. Even soil characteristics are also observed by deep learning techniques [10]. The continous monitoring of soil is done by using Remote sensing. Depending upon Natural Resource Conservation Service Curve Number Model (NRCS-CN) the spatio-temporal diffrences can be find out [11] . The potential soil water retention can be reduced by using NRCS-CN model. The NRCS-CN with Geographic Information System will investigate land-use in certain area. This paper emphasized on the combination of wirless sensors and IOT for smart farming [12]. The Excessive use of chemicals by machines may damage the crops. The excessive usage of latest technolgies may spoil the environnment. Some of the authors have used Robots and machine learning techniques which is not understood by farmers as they are illiterate. The cost of this systems are very high. The farmers have less practical knowledge so they are unable to manage modern machinery.
Hence the above methods have draw backs , a novel technique is built by combining some of the techniques in the above literature survey. In our research paper modular node sensor is used with WI-FI so the farmers can continously monitor the fields and increase their production of crops.

III. Proposed System

Here Arduino UNO board is used along with bridge wave rectifier, water level sensor (Robodo-Rel35),Soil moisture sensor (REES52), temperature sensor (DS18B20) ,LCD (Liquid Crystal Display-NT-C1611) display, D.C motor (l293D) and IOT. The Arduino UNO uses ATMEGA328 Microcontroller.

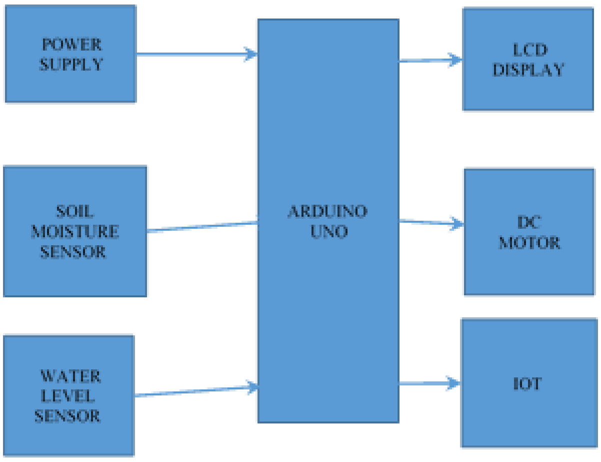

Fig. 1. Block Diagram for precision farming

It is having fourteen digital input and output pins and six analog pins. Its clock frequency is 16 MHz. It needs 5v power supply for proper operation of the circuit. By using 6 PWM (Pulse Width Modulation) pins the circuit is connected. The sensors are connected to 2,3, and 4 digital pins in Arduino board. When soil moisture sensor is put in a boul with dry soil then motor then LCD will display “soil is dry”. Now motor become ON and starts roatating. It will pour water to the fields. When soil moisture sensor senses the soil as wet then the motor stops rotating and the LCD displays “soil is wet”. By using modular node sensor network it will send message to our mobile using WI-FI. The waer level sensor detects the water level in farming or culivation. All these operations are done “read” and “write” instructions in Arduino-IDE (Integrated Development Environment) software. Similarly the temperature sensor will sense the temparature of the environment. The block diagram of precision farming is shown in Figure 1.The Arduino UNO board is shown I figure 2. The specifications of ARDUINO UNO is mentioned in Table I. The Figure 2 depicts pin out diagram for ATMEGA328 Microcontroller. It has got 28 pins as shown in figure 3.

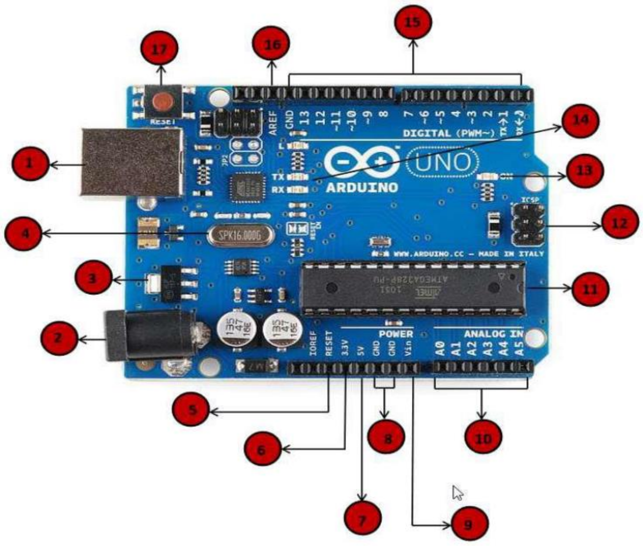

Fig. 2. Arduino UNO board

In Arduino UNO board some numbers are indicated with red colour. The number 1 indicates USB interface. The number 2 depicts about external power supply. The voltage regulator is shown by nummber 3. The number 4 explains about crystal oscillator. The number 5 indicates RESET pin which resets the Microcontroller. The number 6 indicates 3.3V output voltage. The number 7 indicates supply voltage which is given to Arduino board. The number 8 determines GND pins. The number 9 depicts about $V_{IN.}$ The number 10 indicates six Analog pins marked by A_{0}-A_{5}.The number 11 shows ATMEGA 328 Microcontroller which is manufactured by ATMEL company. The number 12 is ICSP pin which is Serial Pheripheral device (SPI). The SPI will slave the output device to the master with the help of master bus. The number 13 is power Light Emitting Diode (LED) indicator. The transmitter (TX) and Receiver(RX) is indicated by number 14. The number 15 shows fourteen digital I/O pins and they are represented by D_{0}-D_{13}. Six of which provides PWM. The number 16 indicates AREF which means Analog Reference.

Table I: Specifications of Arduino UNO

Feature	specfications
Microcontroller	ATMEGA328
Supply voltage	15V
Clock frequency	16 MHz
SRAM	2KB
EEPROM	1KB
D.C Current for the I/O pins	40mA
D.C Current for the 3.2V pins	50mA
Flash memory	32KB
Analog input pins for Arduino	6
Digital input pins for Arduino	14
Input voltage	7V-12V

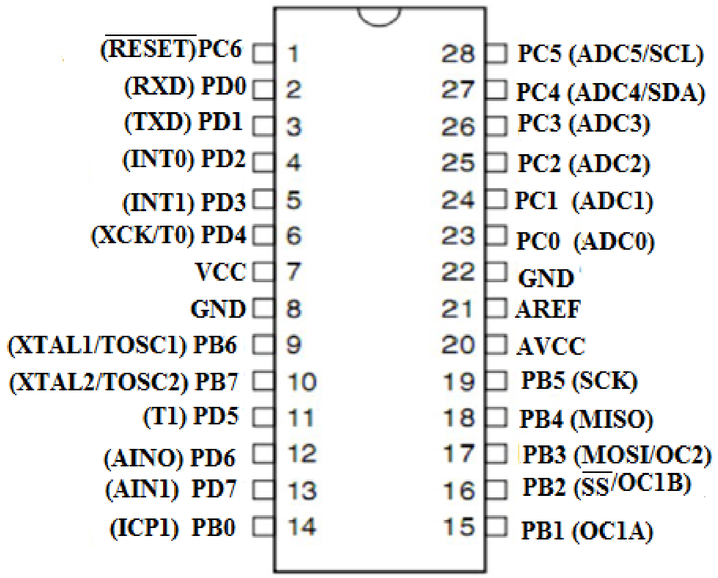

Fig. 3. Pin out diagram for Micro contoller ATMEGA 328 in Arduino UNO

The PB, PC , and PD indicates port B, port C and Port D pins rspectively. The port B is a Bidirectional port with 8 bits. It has several internal pull up resistors. The Port B buffer has drive characteristics which are symmetrical at the ouput. When the input is low at Port B then pull-up transisors are activated. The port B is in high impdedance state when RESET Pin is acivated. The AREF pin is Analog Reference pin for Analog to Digital converter. The eigth pin is supply pin and the twenty second pin is ground pin. The port C is a Bidirectional port with 7 bits. It has several internal pull up resistors. The Port C buffer has drive characteristics which are symmetrical at ouput. When input is low at Port B then pull-up transisors are activated. The port C is in high impdedance state when RESET Pin is acivated. The port D is a Bidirectional port with 8 bits. It has several internal pull up resistors. The Port D buffer has drive characteristics which are symmetrical at ouput. When the input is low at Port D then pull-up transisors are activated.

IV. RESULTS

After performing experiment on Arduino-UNO with precision farming circuit, certain results was observed on LCD display. The Figure 4 shows all the sensors connected to Aurdino-UNO board with jumper wires. The supply voltage is taken from 7805 IC regulator, which gives 5V as output. The Figure 5 is displaying soil condition as “Dry” when moisture sensor is put in a dry soil. The Figure 6 depicts that cultivation is under A.E. The Figure 7 explains that there is hot condition and it is detected by temperature sensor. The Figure 8 depicts about temperature and humidity conditions. The temperature senses temperature of sorroundings and also senses humidity in air. The LCD is displaying about water level in Figure 9.

Fig. 4. LCD displaying normal water level

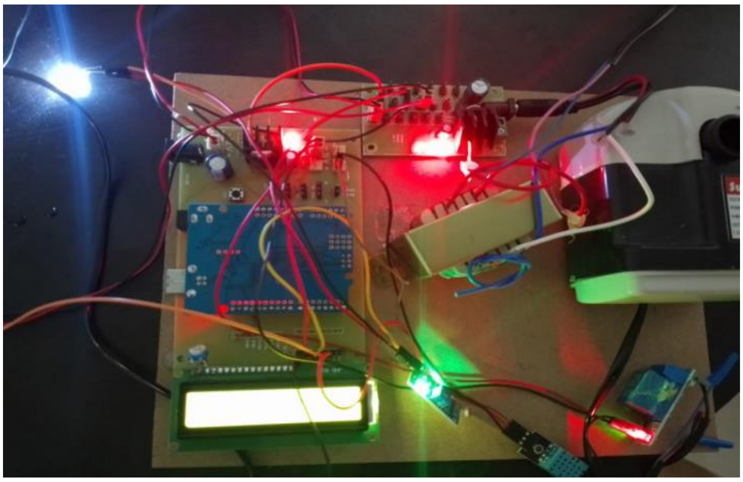

Fig. 5 . Precision Farming Kit using Arduino board

Fig. 6. LCD displaying cultivation condition

Fig. 7. LCD displaying about soil condition

Fig. 8. LCD displaying hot condition

Fig. 9. LCD displaying temperature and humidity

V. Conclusion And Future Scope

In this research paper a new precision farming technique is implemented by using WSN, multi node sensor and IOT. An automatic farming can be done by using this technique. In this controlling and monitoring of farming is done and the production has been increased. The Precision cultivation and farming has been tested by using modular node sensor. The novel technique outperforms the existing techniques.

Instead of modular node sensor, GPS can be used with multi numbers to give information to multiple users. So, the farmers can know the information quickly and take action immediately by using mobile phone itself.

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