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Techi-Farming using Zig-Bee with WSN Architecture and NPK Sensor

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Abstract – An automatic irrigation control system has been intended to enable the automatic supply of satisfactory water from an artificial lake to field or domestic crops in all agricultural seasons. The way hired is to continuously display the soil moisture level to choose whether irrigation is needed, and how much water is needed in the soil. A moisture sensor was built to model the electrical resistance of the soil. The pumping subsystem entailing a submersible low-noise micro water pump was built using a small DC operated motor. Temperature and Humidity is identified using DHT11 and the NPK sensor is used for Nitrogen, Phosphorus, Potassium sensing. All these data are powered using a Solar Panel linked to GSM. All these are stored in the cloud and controlled using Mobile Application.

Index Terms – GSM, Zig-Bee, DHT11, NPK Sensor, Moisture Sensor, Solar Panel.

1. INTRODUCTION

Agriculture is the principal source of maintenance for about 59 percent of India's inhabitants. Gross Value increases by agriculture, forestry and casting are estimated at Rs 18.54 trillion (US$ 271.00 billion) in FY18. The Indian food trade is composed of massive growth, increasing its role to flora and fauna food craft every year due to its huge latent for value count, predominantly within the food dispensation trade. The Indian food and grocery market is the world's sixth-largest, with retail paying 70 percent of the sales. The Indian food dispensation industry accounts for 32 percent of the country's total food souk, one of the largest industries in India and is graded fifth in terms of production, feeding, transfer and likely evolution. It pays around 8.80 and 8.39 percent of Unsophisticated Value Added (GVA) in Trade and Farmed individually, 13 percent of India's distributes and 6 per cent of whole trade investment. All these features are affected due to the Agricultural flaws like water inadequacy which is due to the major custom of water. Another issue is the crops for the soil, every soil has different nitrogen level based on the crops to be planted.

2. RELATED WORK

In irrigation systems, many studies carried out by the up-to-date technologies for effectual consumption of water, energy and raise the yield [1]. Irrigation System in the south-east region which is contained in Spain has a local control system. That helps in nursing the water sent to irrigate each day and to monitor the process of a pumping station and failure detection. The operation of these ideas assisted to rise crop production and better excellence of fruits. This paper principally focuses on the water content [2] that is contained in the water chamber and then the nonstop flow monitor's the level of the water. It is divided into two units namely: Master Unit (MU) and Slave Unit (SU).

One of the methods is proposed by Md. Razu Miah from the Dept. of Master Unit has the role of nursing the whole link and this unit is chiefly used to check the position of water level at a certain tank and then it shows the water level in the Primary Unit. Also by taking the input from the user, it keeps the water at an exact level. As soon as the arrangement power's up, Wireless Sensor Network (WSN) (a) initializes the protocol stack (b) drafts the wireless network links and (c) initiates all Slave Units. When the initialization procedure has been finalized, the Slave Unit will be associated with the network and it directs the status of the water level. The water level that is sent from the Slave Unit will be displayed on the LCD.

In this paper Arduino microcontroller withstand moisture sensor and water flow sensor is used for an automatic irrigation systems. Moisture content of the soil is detected by Arduino microcontroller and data is directed using ZigBee protocol. When the moisture level reaches the pre-set level, the flow of water in the pipe is adjusted accordingly. All the data such as flow, water pressure, moisture level ,etc. updated in the database along with time by which one can check the position of moisture level and motor running time on display and also on mobile via GSM.

This paper designates the humidity [3] content in the soil. This system is based on the concept of microcontroller and its program is based on assembly level language. Here the humidity sensor is placed nearby the tree and it should be kept below the superior layer of soil. In each sensor, the minimum humidity level will be set. Now when the humidity of the soil goes below the value that has been set, the comparator will be set high and finally all the outputs of the comparator will be connected to the logic circuit(OR gate). The output is then united to the instrumentation amplifier which provides

adequate current to ADC channel. In case if any channel finds the high data, it switches on the transmit and motor. The motor's outlet pipe is connected to the valves of different areas.

The opening and closing of the valve will be controlled by the micro-controller. This process will be done concurrently by the stepper motor. When the valve is opened the motor will be ON and when the valve is closed the motor will be OFF. Here the different types of irrigation management [4] help in maximizing the yield and saving the water. This irrigation system makes use of the PIC micro-controller. The field condition will be continuously monitored by in-field sensors and this information will be transferred to GPS (Global Positioning System). It then communicates with the computer wirelessly. Data is got from the sensor network and this data will be interfaced using Bluetooth communication. Wireless Sensor Network (WSN).

Mainly used for sensing temperature, wind and air. The sensed information will be sent to the base station. At the base station, the GPS is riding on the cart which is used for endlessly updating the geo referential information from the irrigators.

Based on the head of the irrigator the base station sends the control signal back to the irrigation control station to apply the quantified depth of water. Real-Time Automation of Farming Environment nonstop monitoring the soil moisture and checking the humidity as well as the temperature of the soil.

It is done by the use of GSM (Global System for mobile communication). Here, a soil moisture sensor is used which measures the moisture of the soil and it informs the centralized unit [5]. Now, this unit will send the SMS to the end-user through GSM (Global system for mobile communication).

The centralized unit is programmed to wait for a certain period for the response from the end-user. If the user does not give any response, then the system monitors the values continuously.

The proposed paper explains innovative technology for expanding the irrigation areas to satisfy the demand for food, fiber and feed. Most of the countries have the pressure to produce effectively more food with less amount of water.

3. PORPOSED MODELLING

3.1. Overview

Optimize the use of water in irrigation. Monitor the moisture level of soil continuously. Send moisture level alert to the mobile. Switch on/off motor based on the moisture level. Control motor remotely from anywhere. ZigBee technology is used for low-cost and easy transmission. Solar panels for power supply. Arduino board module, equipped with a solar panel and a Li-Ion can power your Arduino project in two ways: either by linking your Arduino board to the component and the component to its solar panel; or by connecting the Li-Ion battery to the solar panel then the solar panel to your Arduino board via a pair of 5 V wires. You can care for your Li-Ion battery from the solar panel from a USB cable linked to your system. Hard to run out of power under these environments.

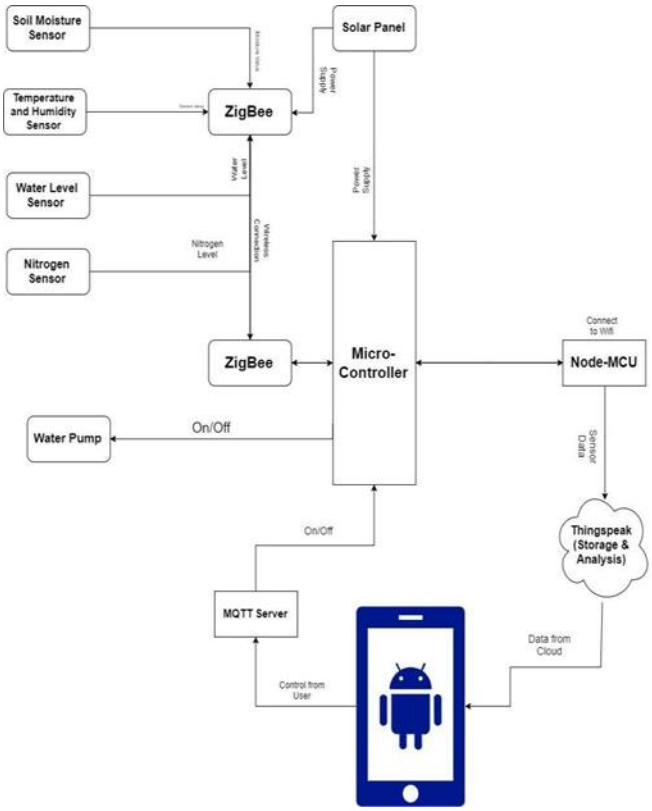

Figure 1 Block Diagram of Proposed System

3.2. Architectural Specification

3.2.1. Moisture Sensor

Firstly the process is to detect the moisture level of the soil. The detected value is taken into a controller. The detected values are also stored for the analysis. Using the analysis the moisture level can be identified earlier. Moisture is stored in a cloud. A Soil Moisture Sensor consists of two components. A two diode Lead that goes into the soil or anywhere else where water content has to be measured. This has two heading pins that attach to an Amplifier/ A-D trip which is in turn linked to the Arduino. The Amplifier has a VIN, Ground, Analog and Digital Information Pins. This means that you can get the ideals in both Analog and Digital forms. Most soil moisture sensors are designed to guesstimate soil volumetric water content based on the dielectric constant (soil bulk permittivity) of the soil. The dielectric constant can be assumed as soil's ability to transmit electricity. The dielectric constant of the soil rises as the water content of the soil increases. This response is due to the detail that the dielectric constant of water is much larger than the other soil components, as well as air. Thus, the extent of the dielectric constant gives an expected guesstimate of

water content.

3.2.2. Motor Controller

According to the moisture level motor is switched on/off. The motor is controlled by a controller it sends aware to the mobile. The user chooses whether to switch on/off the motor. It can also be switched on/off automatically if the user sets in automatic mode. If the tank is out of the water it also indicated to user earlier.

3.2.3. Temperature Sensor

The temperature of the nearby crops is much more important. DTH11 sensor is used to detect the temperature of the surrounding crops. A thermistor is a variable resistor that changes its resistance with the variation of the temperature. These sensors are made up of semi-conductive resources such as ceramics or polymers to provide larger changes in the resistance with just small changes in temperature. The term NTC means Negative Temperature Coefficient and which means that the resistance decreases with the increase of the temperature.

3.2.4. Nodemcu Connection to Thingspeak

Node-MCU is a Wi-Fi-module used to link to the cloud Thingspeak. API keys are used in the program to connect and transfer information to Thingspeak. Internet of Things (IoT) describes an evolving trend where a large number of embedded devices are connected to the Internet. These linked devices communicate with people and other belongings and often provide sensor data to cloud storage and cloud computing resources. Where the data is processed and analyzed to gain important visions. Cheap cloud computing power and increased device connectivity are empowering this trend. IoT resolutions are made for many upright applications such as environmental monitoring and control, health monitoring, vehicle fleet monitoring, industrial monitoring and control, and home automation.

3.2.5. Moisture Data to Thingspeak

The readings given by the moisture sensor is given to the cloud service "Thingspeak". Node-MCU is used to transfer information from moisture sensors to Thingspeak. Thingspeak is cloud storage where all the information can be analyzed. It helps us to take an examination of the moisture reading. DC motor has two primes one is positive and another one is negative. If we link them directly to the Arduino board then it will damage the board. To overcome this problem, the NPN transistor is used to control the switching movement of the motor according to the code.

3.2.6. Integration

All these segments are interfaced into a single module which will help the farmers to automate the irrigation. It will also help the user to save water for forthcoming use. It also has an alert system namely, Low moisture level. Low water level. Temperature & Humidity Indicators. All these features are interfaced with mobiles.

3.2.7. Humidity Sensor Using DHT11

Humidity is also sensed using the DHT11 sensor which is very important. Humidity is the amount of water contented in the atmosphere and surrounding of the crops. For computing humidity, they use the humidity sensing module which has two electrodes with moisture holding substrate between them. So as the humidity changes, the conductivity of the substrate variations or the resistance among these electrodes changes. This change in resistance is measured and managed by the IC which makes it ready to be read by a microcontroller.

4. RESULTS AND DISCUSSIONS

In Figure.2.1 the moisture sensor data values are transported to the Thingspeak using Node MCU. Mat Lab analysis is used in the Thinspeak to provide analysis on the data. The temperature and humidity sensor in Figure 2.2 and Figure 2.3 is detected using DHT11. In Figure 2.4 all these temperature values are taken in the Mat Lab Analysis and provided with the 3-day difference of the temperature of the field.

Figure 2.1 Moisture Sensor Readings in Thingspeak with Analysis

Figure 2.2 Temperature Sensor Readings in Thingspeak with Analysis

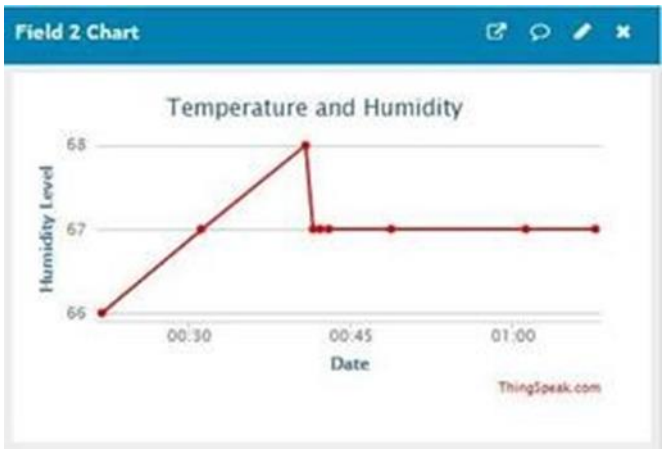

Figure 2.3 Humidity Data to Thingspeak with Analysis

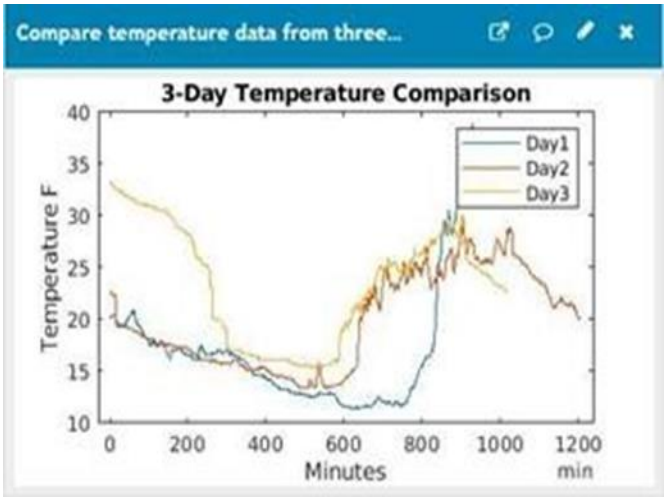

Figure 2.4 Temperature differences of the cultivation lands

5. CONCLUSION

Techi farming and accuracy agriculture contain the integration of cutting-edge technologies into existing farming observes in order to raise production efficiency and the quality of agricultural products. As an additional benefit, they also improve the quality of life for farmworkers by reducing heavy labor and dreary tasks. Just about every part of farming can benefit from technological developments from planting and watering to crop health and harvesting. Most of thepresent and awaiting agricultural technologies drop into three categories that are predictable to become the pillars of the smart farm: independent robots, hums or UAVs, and sensors and the Internet of Things (IoT). Subsurface Drip Irrigation (SDI) is previously a leading irrigation method that permits farmers to switch when and how much water their crops admit. By union these SDI systems with gradually cultured IoT-enabledsensors to endlessly screen moisture levels and plant health, farmers will be able to interfere only when needed, otherwise authorizing the system to work autonomously.

6. FUTURE ENHANCEMENT

Soil moisture sensors can be designed to the various types of soil. A database can be formed. It can be used to govern the types of acids, alkalis or salts existing in the soil. The Salinity of soil can also be calculated by correlating it with the output voltage. We can get the values from stored database in PC so that the moisture holding capacity of the soil can be determined. Smart Farming has a real potential to deliver a more productive and sustainable agricultural production, based on a more precise and resource-efficient approach.

Nevertheless, while in the USA probably up to 80%of farmers use some kind of SFT, in Europe it is no further than 24%. Third Green Revolution is taking over the agricultural world built upon the combined application of ICT solutions such as care equipment, the Internet of Things (IoT), sensors and actuators, geo positioning systems (GPS), Big Data, Unmanned Aerial Vehicles, robotics, etc. The tractor is the heart of a farm, used for many different tasks contingent on the type of farm and the formation of its auxiliary equipment.

REFERENCES

[1] Aashika Premkumar, P Monishaa, Thenmozhi K, Rengarajan Amirtharajan, International Conference on Computer Communication and Informatics (ICCCI -2018), Jan. 04 – 06, 2018, Coimbatore, INDIA "IoT Assisted Automatic Irrigation System using Wireless Sensor Nodes"..

[2] Ramya and G. Ravi, "Efficient automatic irrigation system using ZigBee," 2016 International Conference on Communication and Signal Processing (ICCSP), Melmaruvathur, 2016, pp. 0379-0383.doi: 10.1109/ICCSP.2016.7754160.

[3] P. B. Chikankar, D. Mehetre and S. Das, "An automatic irrigation system using ZigBee in wireless sensor network," 2015 International Conference on Pervasive Computing

[4] L. Bhaskar, B. Koli, P. Kumar and V. Gaur, "Automatic crop irrigation system," 2015 4th International Conference on Reliability, Infocom Technologies and Optimization (ICRITO) (Trends and Future Directions), Noida, 2015, pp. 1- 4doi:10.1109/ICRITO.2015.7359336.

[5] Sathya, B. Arthi, S. Giridharan, M. Karvendan and J. Kishore, "Automatic control of irrigation system in paddy using WSN," 2016 IEEE Technological Innovations in ICT for Agriculture and Rural Development (TIAR), Chennai, 2016, pp. 115-118. doi: 10.1109/TIAR.2016.7801224.

[6] W. q. He, M. k. Cai, Y. b. Wang and X. j. Wang, "Automatic Water Supply Control System of Graded Constant Pressure by Variable Frequency Speed and Its Application to Pipeline Irrigation," 2010 Second WRI Global Congress on Intelligent Systems, Wuhan, 2010, pp. 385- 388.doi: 10.1109/GCIS.2010.8.

[7] S. f. Yang, J. y. Guo and X. q. Wang, "Detecting of water shortage information in crops with acoustic emission ssstechnology and automatic irrigation system," 2008 Symposium on Piezoelectricity, Acoustic Waves, and Device Applications, Nanjing, 2008, pp. 566-569. doi: 10.1109/SPAWDA.2008.4775854.

[8] P. H. Tarange, R. G. Mevekari and P. A. Shinde, "Web based automatic irrigation system using wireless sensor network and embedded Linux board," 2015 International Conference on Circuits, Power and Computing Technologies [ICCPCT-2015], Nagercoil, 2015, pp. 1-5.doi: 10.1109/ICCPCT.2015.7159327.

[9] N. Putjaika, S. Phusae, A. Chen-Im, P. Phunchongharn and K.Akkarajitsakul, "A control system in an intelligent farming by using arduino technology," 2016 Fifth ICT International Student Project

Conference (ICT-ISPC), Nakhon Pathom, 2016, pp. 53-56
[10] P. Y. Dattatraya, J. Agarkhed and S. Patil, "Cloud assisted performance enhancement of smart applications in Wireless Sensor Networks," 2016 International Conference on Wireless Communications, Signal Processing and Networking (WiSPNET), Chennai, 2016, pp. 347-351.
[11] P.R.Harshini, T.Umashwari, R.Tharini, S.Rajalakshmi, J.Dharani, " Effective Crop Productivity and Nutrient level Monitoring in Agriculture soil using IoT ", 2018 International Conference on Soft-computing and Network Security (ICSNS),Nagercoil, 2015, pp. 1-5.doi: 10.1109/ICCPCT.2015.7159327.
[12] S. Gowri and G. Divya, "Automation of garden tools monitored using mobile application," International Conference on Innovation Information in Computing Technologies, Chennai, 2015, pp. 1-6.doi: 10.1109/ICIICT.2015.7396084.