Multidisciplinary Approach for Connecting Agriculture to IOT through WSN

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ABSTRACT

The Internet of Things (IOT), the idea of getting real-world objects connected with each other, will change the way users organize, obtain and consume information radically. Internet of Things (IOT) enables various applications (crop growth monitoring and selection, irrigation decision support, etc.) in Digital Agriculture domain. The Wireless Sensors Network (WSN) is widely used to build decision support systems. These systems overcomes many problems in the real-world. One of the most interesting fields having an increasing need of decision support systems is Precision Agriculture (PA). Through sensor networks, agriculture can be connected to the IoT, which allows us to create connections among agronomists, farmers and crops regardless of their geographical differences. With the help of this approach which provides real-time information about the lands and crops that will help farmers make right decisions. The major advantage is implementation of WSN in Precision Agriculture (PA) will optimize the usage of water fertilizers while maximizing the yield of the crops and also will help in analyzing the weather conditions of the field.

Keyword: - Agriculture, *Internet of things, Wireless Sensor Network,*

1. INTRODUCTION

Drip irrigation is artificial method of supplying water to the roots of the plant. It is also called micro irrigation. In past few years there is a rapid growth in this system. The user communicates with the centralized unit through internet. The centralized unit communicates with the system through SMS which will be received by the IOT with the help of the smart phone. The sends this data to Raspberry Pi which is also continuously receives the data from sensors in some form of codes. After processing, this data is displayed on the computer. System receives the activation command from the subscriber it checks all the field conditions and gives a detailed feedback to the user and waits for another activation command to start the motor. The motor is controlled by a simple manipulation in the internal structure of the starter. The starter coil is indirectly activated by means of a transistorized relay circuit. When the motor is started, a constant monitoring on soil moisture and water level is done & once the soil moisture is reached to sufficient level the motor is automatically turned off & a massage is send to subscriber that the motor is turned off. The further use of this implementation of technology is to display the value of temperature on mobile phone. The PH sensor is used to measure the contents of water in soil. The humidity sensor used to calculate the of water in air. Day by day there is deficiency of water capitals in India. There are the drought like conditions after gap of every certain year in the country. So efficient use of the water is became necessary. Also the chemical enrichers used in the excess amount are harmful for the health of the soil, so need of the optimum use of the fertilizers. These causes lead to the automation of the irrigation and the fertilizer application i.e. the fertigation. Modern irrigation techniques saves water as well as the having efficiency to get this water to plants is higher than conventional method. Fertigation is nothing but the irrigation + fertilizer application but in this case fertilizers are the water soluble fertilizers. In the agriculture there are lot many soil nutrients have to be provided to the plants. These kind of work is done through insertion of them into the existing drip laterals.

2. PROPOSED SYSTEM

The block diagram of the proposed system as shown in Fig. consists of different types of sensing unit such as Soil Moisture Sensor to measure water content of soil, Temperature Sensor detects the temperature, Humidity Sensor to measure the presence of water in air.

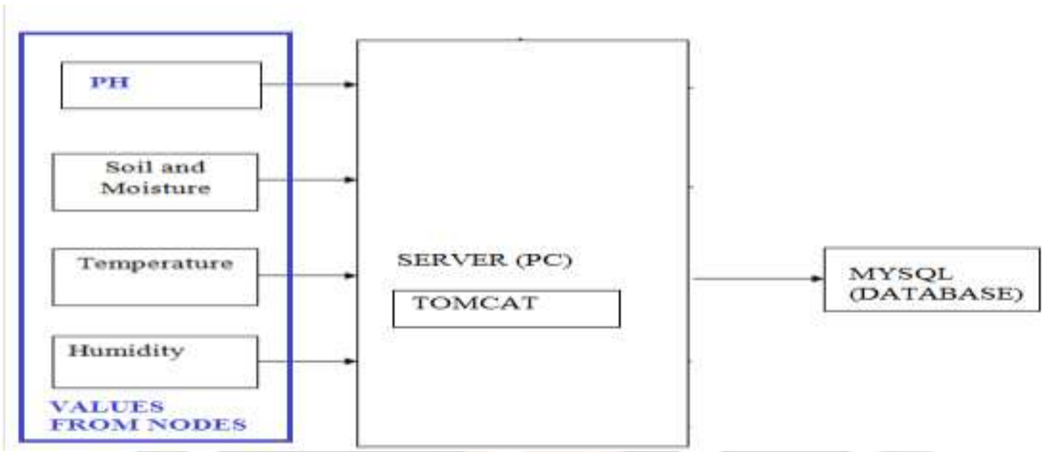

Diagram-1-: Proposed system design

2.2 Proposed System Working

There are 2 modes of operation:
a. Manual Modes
b. Automatic Mode

In this project, webcam is interfaced to Raspberry Pi via Wi- Fi module. Here the raspberry Pi takes snapshot wirelessly using Mobile camera. Then Rasp berry Pi will do image processing to find out the soil color samples. According to soil samples the Pi will send the information to user on the android app regarding the soil and seeds / crops which can be used on this type of soil. Furthermore, DC motor based vehicle is designed. The camera is mounted on the vehicle. The vehicle is stopped in front of a crop / plant. Soil and moisture electrodes will be inserted in soil. If electrode is not fully immersed in the soil due to any obstacle, the vehicle will move further and repeat the process unless and until the electrodes are not fully immersed. Once immersed, the moisture contents will be checked. If inadequate then water will be supplied to that particular plant. Also depending on the values of temperature and humidity sensors, the water motor will be turned on an off respectively. This process will be repeated for all the plants. The Pi will also take snapshots of the plant for intervals of few days and calculate the growth of plant using the height and width parameters. If the plant growth is adequate then Pi will continue the process for next plants. If the growth is insufficient then Pi will spray fertilizer o the plant and send an indication to user on android app. Also Android App based server is designed as part of this project. The android app will have a GUI which will show all the data to user. The modes as specified can be selected by the user on the app itself. In manual mode, the DC motor based vehicle will move ahead with the fixed distance as it will be assumed that plants are present at same distance. In automatic mode, the user will be able to move the vehicle forward, reverse or left and right through app. This can be done within range of 30m as it is done using Wi-Fi.

3. Design of the System

The block diagram of the Smart irrigation and fertigation system is as shown in The fig. meaning and functionality in short w.r.t. block diagram is as follows:

3.1 Sensor for soil moisture

The Soil Moisture Sensor is used to measure the volumetric water content of soil. This makes it ideal for performing experiments in courses such as soil science, agricultural science, environmental science, horticulture, botany, and biology. Use the Soil Moisture Sensor to:

• Measure the loss of moisture over time due to evaporation and plant uptake.

• Evaluate optimum soil moisture contents for various species of plants.

• Monitor soil moisture content to control irrigation in greenhouses.

• Enhance your Bottle Biology experiments.

The soil moisture sensor basically used to measure the content of the water in the soil present. According to that the water is dropped to the crop area. The sensor used here is made up of the two probes and the variable resistors. The resistance between two points is further represented as the electrical voltage.

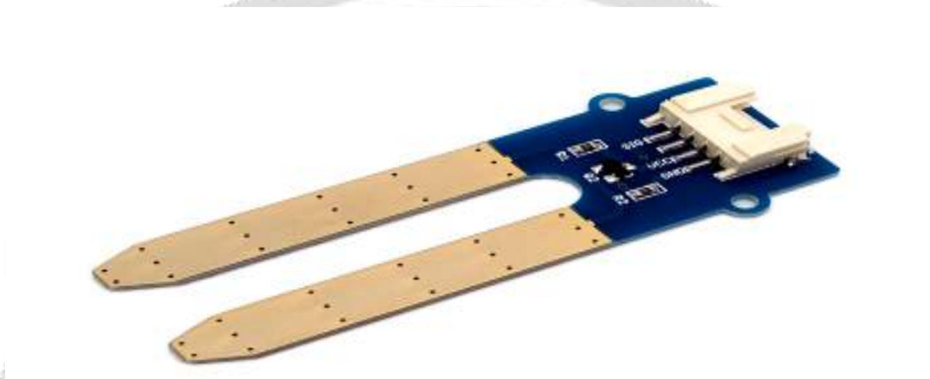

Fig -1: Soil moisture Sensor

3.2 Temperature sensor

Here LM35 is used. The LM35 is an IC sensor. The temperature is measured and according to that the output is displayed, which is proportional an in degree Celsius. The LM35 series are precision integrated-circuit temperature devices with an output voltage linearly-proportional to the Centigrade temperature. The LM35 device has an advantage over linear temperature sensors calibrated in Kelvin, as the user is not required to subtract a large constant voltage from the output to obtain convenient Centigrade scaling. The LM35 device does not require any external calibration or trimming to provide typical accuracies of ±¼°C at room temperature and ±¾°C over a full −55°C to 150°C temperature range. Lower cost is assured by trimming and calibration at the wafer level. The low-output impedance, linear output, and precise inherent calibration of the LM35 device makes interfacing to readout or control circuitry especially easy. The device is used with single power supplies, or with plus and minus supplies. As the LM35 device draws only 60 µA from the supply, it has very low self-heating of less than 0.1°C in still air. The LM35 device is rated to operate over a −55°C to 150°C temperature range, while the LM35C device is rated for a −40°C to 110°C range (−10° with improved accuracy). The LM35-series devices are available packaged in hermetic TO transistor packages, while the LM35C, LM35CA, and LM35D devices are available in the plastic TO-92 transistor package. The LM35D device is available in an 8-lead surface-mount small-outline package and a plastic TO-220 package

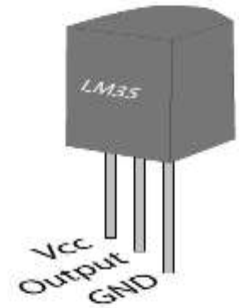

Fig -2: Temperature sensor

3.3 Humidity sensor

It gives the humidity in the atmosphere. This sensor checks the presence of water in air. The amount of water vapor in air can affect the plants growth. The presence of water vapor so influences various physical, chemical, and biological processes. The intelligent humidity sensor is an indirect, calibrated method of measuring soil water. It is an electrical capacitance type sensor, the assembly along with casing of Intelligent Soil humidity sensor is shown in figure which measures the electrical capacitance and transmits to a embedded processor.

Fig -3: Humidity sensor

3.4 Pumps

The water pump is used to artificially supply water for a particular task. It can be electronically controlled by interfacing it to a microcontroller. It can be triggered ON/OFF by sending signals as required. The process of artificially supplying water is known as pumping. There are many varieties of water pumps used. This project employs the use of a small water pump which is connected to a H-Bridge. We are using 19 watt submersible motor. It is low voltage fully submersible motor having no noise, small size and no maintenance. The sensors are placed in the fields to collect the data from the environment and send it to the controller. After processing the data, if the value is above the threshold then the pump will be off and if it is below the threshold then it will be started feeding water to the field. The pumping of water is a basic and practical technique, far more practical than scooping it up with one's hands or lifting it in a hand-held bucket. This is true whether the water is drawn from a fresh source, moved to a needed location, purified, or used for irrigation, washing, or sewage treatment, or for evacuating water from an undesirable location. Regardless of the outcome, the energy required to pump water is an extremely demanding component of water consumption. All other processes depend or benefit either from water descending from a higher elevation or some pressurized plumbing system.

Fig -4: Water Pump

4. ADVANTAGES

- Fertilizer and nutrient loss is minimized due to localized application and reduced leaching.
- Water application efficiency is high if managed correctly
- Field leveling is not necessary.
- Fields with irregular shapes are easily accommodated.
- Recycled non-potable water can be safely used.
- Moisture within the root zone can be maintained at field capacity.
- Soil type plays less important role in frequency of irrigation.
- Soil erosion is lessened.
- Water distribution is highly uniform, controlled by output of each nozzle.
- Labor cost is less than other irrigation methods.
- Variation in supply can be regulated by regulating the valves and drippers.
- Fertigation can easily be included with minimal waste of fertilizers.

5. CONCLUSION

As an important constituent part of the IOT, sensor networks enables us to interact with the real world objects. In this project we are dealing with the sensor network design that enables connecting agriculture to the IOT. The connection sets up the links among agronomists, farms, and thus improves the production of agricultural products. It is a comprehensive system designed to achieve precision in agriculture.

6. FUTURE SCOPE

The future scope of this system will include the intelligent system which will take the decisions or actions according to the conditions prevailing. So that the farmer's interaction with the system will be minimized which will lead to less human efforts for the monitoring. This will allow farer to vilipend the nominal warnings as system will take care of it, which will be a lucrative deal for the end user

7. REFERENCES

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