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Real-Time Monitoring Of Agricultural Activities Using Wireless Sensor Network

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Abstract: ***With the advancement in technology, the world around us in every part of our life getting automated. The manual procedures are being replaced by these automated systems, since they are with energy efficient and consume less labor work. This paper proposes the advantages of having Wireless Sensor Network technology in Indian agricultural sector, which shows the path to the rural farmers to replace some of their traditional techniques. Here, multiple environmental data such as Humidity, Soil moisture, Soil pH etc. are collected by a set of wireless sensor nodes and applied as input to the Peripheral Interface Controller (PIC). The data is checked continuously by PIC controller and a set of control actions like Irrigation, Soil fertility check etc. are made if they exceed threshold level. After every activity, an evidence message is sent through SMS via GSM modem to the farmer. The module by module design and implementation of the system are given. The system overcomes the limitations of traditional agricultural procedures by utilizing water resource efficiently and also reducing labor cost.***

Keywords: Precision Agriculture, Humidity sensor, Soil Moisture, PIC controller.

1. Introduction

Despite of emphasis on industrialization, agriculture remains primary segment of Indian economy both regarding commitment to the gross domestic product (GDP) and in addition a wellspring of job to millions the nation over. Increase in energy crisis, low availability of fresh water for irrigation and uneven environmental conditions are the major factors in agriculture. So, we need some innovation in Indian agriculture (i.e. modern tools and technologies) to improve the production efficiency, quality of yield and also to reduce the environmental impact. Hence, automation in agriculture coins a new concept known as precision agriculture.

A. Precision Agriculture

One of the methods that are showing a good effect in improving crop production and effective resource utilization is Precision Agriculture. It argues that crops quality and production rate is improved by providing right resources at right time in presence of suitable environmental conditions. This makes Precision Agriculture an effective way for utilization of resources and improve production outcome. Precision Agriculture can be achieved through modern technologies which assist computing, communication and control within devices, Wireless Sensor Network suit for this purpose.

B. Wireless Sensor Network

A wireless sensor network is a collection of sensor nodes organized into a cooperative environment. Each sensor node is capable sensing physical parameters like atmospheric pressure, temperature, humidity etc. and also capable of processing the sensed data. The nodes communicate wirelessly and often self-organize after being deployed in a working environment.

The innovative advancement in Wireless Sensor Networks made it conceivable to use in observing and control of Agriculture parameters in rural area. Because of uneven regular conveyance of rain water, it is exceptionally essential for agriculturists to screen and control the desired distribution of water to the crop field or as per the necessity of the crop. There is no perfect irrigation technique available which may be suitable for every climate condition, soil structure and mixture and variety of crops cultures. It is observed that farmers need to manage enormous money because of misfortune in wrong forecast of climate and incorrect irrigation method to crops. In this paper with the development in remote sensor gadgets, it is possible to use them for automatic environment monitoring and controlling the parameters of agriculture.

2. Existing Systems

Today, the farmers are using traditional approaches to monitor their agricultural environment and to irrigate their sugarcane crop. The following are some of the irrigation types that have been used by the farmers.

Irrigation can be defined as simulated use of water to the crop field. The watering system is critical on the grounds that, this can just guarantee the survival of the crops. In the event that the field is watered intensely with water, there are risks that the plant may die because of excessive watering. The water could likewise wash them away during strong force watering. Then again, if there is inadequate water, then additionally there are risks that the plant may die due to starvation.

A. Flood Type Irrigation System

In this kind of system, fresh water is flooded between the sugarcane crops. With the help of this, the lower parts of the stem and roots of the plant made wet. Without any measurements, the fertilizers are added bare handedly to get more productivity. The area between the crop rows become eroded due to the force of water and all fertilizers were deposited at the other end of the crop, in which case the productivity of sugarcane will be low. Due to excess water,

crops are been infected by leaf mold fungi as the surface often stays wet.

Figure 2.1: Flood Type Irrigation system

B. Irrigation Using Sprinklers

Figure 2.2: Sprinklers in Irrigation

The sprinkler type of irrigation system nearly uses half of water sources as that of flood type system. It is not possible to identify precise amount of water supply to the plants. Deepening on weather conditions the irrigation schedule of different crops varies. Continuous fall of water over plant leaves can lead to leaf fungi attack.

C. Monitoring Environment

Here, farmer monitors the agricultural environment manually. Since it is time consuming and also difficult to monitor parameters like soil moisture, pH of soil, temperature etc. So, to overcome these problems we are with the concept known as precision farming.

3. The Proposed Work

The following are the features of automation of agricultural activities system.

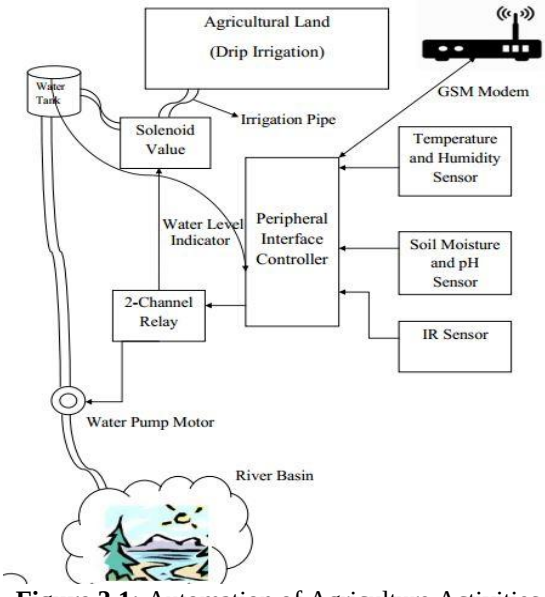

Figure 3.1: Automation of Agriculture Activities

The above diagram illustrates the architecture of proposed system. Firstly, the soil moisture sensor values are analyzed by the PIC controller. If soil moisture and humidity are less than threshold, then PIC controller will understand that the soil is dry and it's time to irrigate the land. So, with the help of solenoid valve the irrigation process takes place. Secondly, Water level indicator will be responsible for ON and OFF of the water pump motor. Soil health can be monitored by PIC controller with the help of soil pH sensor. If pH value exceeds the threshold, an indication message will be sent to the farmer. At last, to identify intrusion into the farm, IR sensor will be deployed, after every detection alarm will be generated. The indication message will be sent via SMS through GSM modem to the farmer.

A. Automatic Irrigation System

The following is the activity diagram for automatic irrigation system.

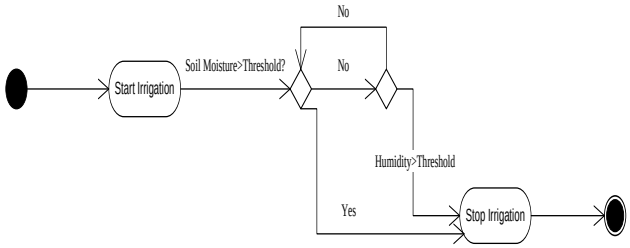

Figure 3.2: Activity diagram for Automatic Irrigation System

Here, if Soil Moisture is less than the threshold and Humidity is greater than threshold, then there may be a chance of rain due to excess humidity. Hence, the irrigation will be stopped. On the other hand, if both Soil Moisture and Humidity are less than threshold, then irrigation will take place by opening the solenoid valve.

B. Soil Health Monitoring

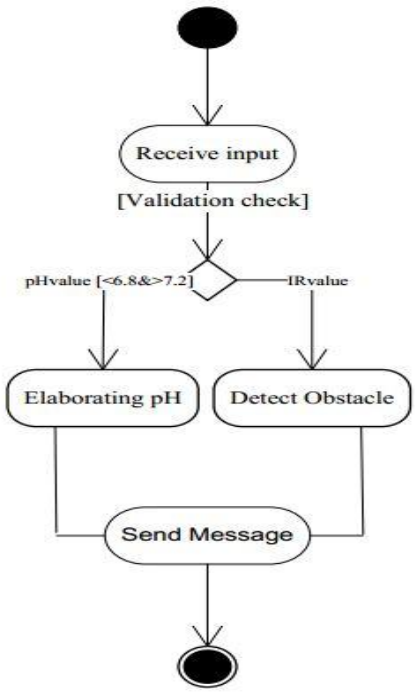

Figure 3.3: Soil Health Monitoring System

Here, soil fertility check is made based on soil pH value. Most of the crops grow effectively in ideal soil pH range of 6.8 to 7.2 as shown above. An indication message will be sent to the farmer via SMS through GSM modem whenever the pH range exceeds threshold value. With the help of this, the farmer came to know about addition of excess fertilizer to the crops or starvation of crops by addition of fewer fertilizers.

4. System Design

To design the proposed system, we need have the following system requirements

A. Hardware Requirement

PIC Controller: Peripheral Interface Controller (PIC) is microcontroller grown by Microchip, PIC microcontroller is quick and simple to execute program.

Figure 4.1: Typical PIC controller

GSM Modem: It is a global system for mobile communication uses microwaves to communicate with other GSM modem or Mobile phone. GSM (Global System for Mobile) / GPRS (General Packet Radio Service) TTL it is a modem with SIM900 quad-band GSM / GPRS device, works on frequencies of 850 MHZ, 900 HZ, 800 MHZ and 1900 HZ. This device is very compact in size and easy to use as plug in GSM Modem. The Modem is designed with 5V DC TTL interfacing circuitry.

Figure 4.2: A typical GSM modem

Humidity Sensor: Humidity is known as the amount of water vapor in the air. Water vapor is in the gaseous state and is not visible to naked eyes. The indication of humidity is precipitation, dew, or fog.

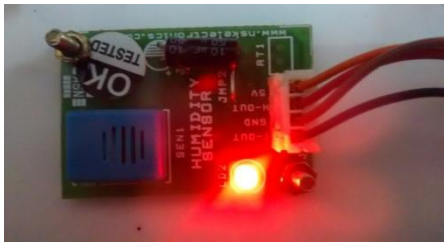

Figure 4.3: Humidity Sensor

The effective rate of evaporation of moisture from the agriculture soil is directly proportional to the humidity. So, irrigation to the crop has to be made based on humidity level in atmosphere of agriculture land. Moisture Sensor: The moisture sensor is used to measure the water content in the soil. Measuring soil moisture is very important in agriculture which helps farmers to manage their irrigation systems more efficiently. Not only they are able to use less water to grow their crop, but also able to increase yields and quality of the crop.

Figure 4.4: Moisture Sensor

pH Sensor: A pH sensor is an electronic device used for measuring the pH value, which is either the concentration of Hydrogen ions in an aqueous solution or the activity of the Hydrogen ions in an aqueous solution.

Figure 4.5: A typical pH sensor

If the solution is acidic (below 7) or basic (above 7) pH ranges from 0 to 14. In agriculture, pH sensor is used to detect the usage of excess fertilizers to the crop.

B. Software Requirements

Micro_C Version 2.5.6.1: It is the software used to write embedded C code, compile and execute them.
PICkit2: It is software used to burn the code into Peripheral Interface Controller.

With the help of all these components, the overall proposed system implementation can be shown as follows.

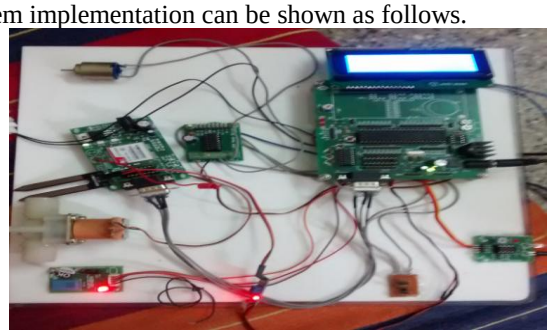

Figure 4.6: The overall view of proposed system

For water pump motor we are using a 5V toy motor and also 5V solenoid valve is used for irrigation purpose. The soil pH 6.5 to 8.0 is ideal for almost all crops, so, threshold for soil pH is set as 6.5 to 8.0. If soil moisture value above 100, then

we predict that the soil is dry and ready to irrigate unless humidity value is less than 80.

5. Conclusion

Precision agriculture provides farmers the ability to apply crop inputs more efficiently than traditional procedures. It provides greater quality crops without harming the environment, "doing the right thing in the right place at the right time" is the strong feature of this system. The proposed system is very low cost model where the real-time environmental data is transmitted to remote area using GSM network. The farmer may use the received data to control the activities of the field.

6. Future Work

The other issue farmers are confronting is the demolition of crops by wild creatures. So the future work incorporates the design of the system which is capable of monitoring the agricultural field by introducing serial cameras and installing sensors at the boundaries. The camera module may take a depiction once the sensor identifies the passage of animals and transmit the real time pictures by coordinating with other data.

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References

[1] K.Prathyusha, M. Chaitanya Suman, "Design of Embedded System for the Automation of DripIrrigation". IJAIEM (2319-4847), vol 1, Issue 2, October 2012
[2] S. Harishankar, R. Sathish Kumar, Sudharsan K.P, U. Vignesh and T.Viveknath, Solar Powered Smart Irrigation System. ISSN 2231-1297, Volume 4, Number 4 (2014)
[3] Drishti Kanjilal, Divyata Singh, Rakhi Reddy, Prof Jimmy Mathew, Smart Farm: Extending Automation To The Farm Level. INTERNATIONAL JOURNAL OF SCIENTIFIC & TECHNOLOGY RESEARCH VOLUME 3, ISSUE 7, JULY 2014
[4] Anjum Awasthi, S.R.N Reddy, Monitoring for Precision Agriculture using Wireless Sensor Network-A Review. Global Journal of Computer Science and Technology Network, Web & Security Volume 13 Issue 7 Version 1.0 Year 2013
[5] Chandrika Chanda , Surbhi Agarwal , Er. B.Persis Urbana Ivy, "A Survey of Automated GSM Based Irrigation System". IJETAE(2250-2459), vol 2, issue 10, October2012
[6] N. Sakthipriya, An Effective Method for Crop Monitoring Using Wireless Sensor Network. Middle-East Journal of Scientific Research 20 (9): 1127-1132, 2014
[7] Shaik Jhani Bhasha, Shaik Mazhar Hussain, Agricultural field monitoring and automation using PIC16F877A microcontroller and GSM. nternational Journal of Advanced Research in Computer Engineering & Technology (IJARCET) Volume 3 Issue 6, June 2014
[8] Prashant B. Yahide, Prof. S.A.Jain, Prof. Manish Giri, SURVEY ON WEB BASED INTELLIGENT IRRIGATION SYSTEM IN WIRELESS SESNSOR NETWORK. Multidisciplinary Journal of Research in Engineering and Technology, Volume 2, Issue 1, Pg.375 -385
[9] Dr. Vandana Tyagi,"India's Agriculture: Challenges for Growth & Develop-ment in Present Scenario", IJPSS, Volume 2, Issue 5, May, 2012
[10] E.Soorya, M.Tejashree, P.Suganya, Smart drip irrigation system using sensor networks. International Journal of Scientific & Engineering Research, Volume 4, Issue 5, May-2013
[11] Prakashgoud Patil, B.L.Desai, Intelligent Irrigation Control System by Employing Wireless Sensor Networks. nternational Journal of Computer Applications (0975 – 8887) Volume 79 – No 11, October 2013
[12] N.Krishna Chaitanya, G.Anand Kumar, P.Aruna Kumari, Zigbee based Wireless Sensing Platform for Monitoring Agriculture Environment. nternational Journal of Computer Applications (0975 – 8887) Volume 83 – No 11, December 2013
[13] Design and Development of a Wireless Sensor Network System for Precision Agriculture by Abhinav Valada, David Kohanbash, George Kantor