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AIMS: Automatic Irrigation Monitoring System using WSN

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Abstract: *For monitoring and control applications Wireless Sensor Networks (WSNs) are most popular technology. The Wireless Sensor Networks (WSNs) provides a new direction of research in agricultural and farming domain. Now days, in various agricultural applications WSNs are mostly applied for smart farming. As we know problem of wasting of water is very much considerable in the farming. The water scarcity is also major problem faced by farmers. The Indian farmers mostly depend on rainy season. Some of the crops like ginger, turmeric etc. require appropriate water. In this paper, by considering all these problems Wireless sensor network (WSN) is deployed on field and that will continuously monitoring real time environmental soil moisture and temperature parameters. And depending on soil condition, required water supply will turn on using solenoid valve for a particular field only, with improved farming. Wi-Fi communication is used for the communication between nodes. This is useful to minimize the wastage of water used in the irrigation process. This project experimentation results clearly shows that the system can effectively reduce the wastage of waters compared to the traditional systems.*

Keywords: Wireless sensor network, Soil moisture sensor, ESP2866.

Introduction:

Agriculture is the backbone of an India's economic activity. Everywhere water scarcity is one of the major problems faced by the farmer. In India, since agriculture is one of the major economies, this situation is overhang. There are various types of the irrigation systems like well water irrigation, canal irrigation, sprinkler irrigation, furrow irrigation etc. but the common problem of this all systems are regarding to wastage of water.

The field surface of the farm is non-uniform all over. It is somewhere up or decreasing in slope. In this case, the supplied water is accumulated at one place. So the proper water is not supplied at complete field. And, due to accumulating water at one place causes the wastage of water. There are few existing systems working for reducing agriculture water consumption. But in these systems watering is done without analyzing the soil parameters due to which system apply non-uniform water to the soil. Also the existing systems require human monitoring. In this regard, we have proposed a wireless sensor network system for irrigation management. The main propose of the automating the process of irrigation is to save the wasting of water. Also to save the consumption of the time required for human monitoring purpose. An improved irrigation system can contribute the efficient management of water used for production of crops. For ensuring proper plant growth and better crop productivity, it is highly necessary to make water available to plants in the right time, at the right location. Also it is highly necessary to make the system low cost and affordable. This project focuses on the continuously monitor the relevant soil parameters like moisture, temperature to derive the references. These derived references will be used for automatic control of the irrigation system.

Related Work:

1) L. L. Pfitscher, D. P. Bernardon, L. M. Kopp, M. V. T. Heckler, J. Behrens, P. B. Montani, B. Thomé.

Rice cropping farms are significant loads in power systems due to the large amount of electrical energy required by the irrigation system. In Brazil, power companies invest in research to improve energy efficiency of this type of load. This paper presents an automated irrigation system based on supervisory control (SCADA) and wireless communication. The main objective of the project is to monitor and control the level of water in the crop, which represents an important impact on energy efficiency and water consumption. A specific characteristic of rice cropping irrigation was taken into account, such as large distances involved and different working schemes of water pumps. A complete solution is presented and it includes equipment description for reliable communication and supervisory features.

2) Sunil More, Mininath Nighot.

In India sustainable agriculture development is essential to meet food demands, economic growth and poverty reduction. Climate change having adverse effect on agriculture and traditional practices followed are planting, fertilizing and harvesting against the predetermined schedule. Precision agriculture can be used to mitigate the climate change. The work objective is optimal usage of water in irrigation, proper nutrient management to plant and avoid crop losses due to diseases and pests with proper scheduling of sprays. In this context, we have proposed an

agro advisory system for the pomegranate field. Wireless sensor network is deployed on field and will continuously monitoring real time environmental, soil, hydrological and crop specific parameters. Those are important for growth, productivity and quality in agriculture. An agro advisory will be disseminated to the farmers according to real time field conditions via SMS and email. The experimental result analysis of proposed system shows improvement over traditional followed methods.

3) Maria Culman, Jesus M. T. Portocarrero, Cesar D. Guerrero, Cristihian Bayona, Jorge Luis Torres, Claudio Miceli de Farias.

In this paper, a Wireless Sensor Network (WSN) solution is proposed for soil's condition measurement to monitor oil palm plantations (PalmNET) according to agricultural meteorological practices. The PalmNET monitoring system is composed by a WSN used for in-field soil's condition measurement and a web-server interface for data visualization. PalmNET can automatically collect soil moisture data and transmit field data through a ZigBee network to a web-server. The PalmNET proof of-concept is a WSN built upon open-source hardware and software, which includes two sensor nodes, a sink and a Gateway with a GPRS module.

4) Divya P1, Surbhi Sonkiya2, Preeti Das2, Manjusha V. V.2, Maneesha V. Ramesh1.

Water scarcity is one of the major problems faced by the whole world. In India, this situation is aggravated since agriculture is one of the major economies. As per the statistics of 2009, India has 35.12% of total land under irrigation. The objective of this work is to reduce the water usage in irrigation processes. In this regard, we have proposed a context aware wireless sensor network system for irrigation management. This multi-sensor system will continuously monitor the relevant environmental parameters, hydrological parameters, soil parameters and crop specific parameters to derive the context. These derived contexts will be used for automatic control and adaptation of the irrigation system. This context aware system uses the real-time sensor data to minimize the wastage of water used in the irrigation process. This research has also proposed an innovative design for horizontal angle adjustment of sprinkler nozzle using stepper motor. This remotely controllable sprinkler system can be wirelessly controlled, based on the decisions derived from the multi-sensors deployed in the agriculture field. The system also includes GSM module, which updates the user about the watering decisions being taken and executed on the fields. This paper describes the experimentation results of this system and it clearly shows that the system can effectively reduce water usage compared to the conventional systems.

System analysis:

PROBLEM DEFINATION:

There are few existing systems working for reducing the agriculture water consumption, but these systems have some limitations. In these systems watering is done without analyzing the soil properties due to which system apply non-uniform water.

Also the system requires more human monitoring and the time consumption is more for monitoring purpose. So it requires modern technology to resolve this problem and support better irrigation management. So developing a system that will help to solve the problem that is related to the water scarcity**.** Here facing a major problem related to water. The water supply to the field is not proper to every corner because the field surface is non-uniform. Due to non-uniform field supplied water is accumulated at a particular area. So the crop in that area gets more water than the requirement. So this directly effects on growing th**e** crop. Also the water is wasted.

So to overcome this problem, developing a system which analyses the soil parameters and according to which water is given to the respective area only.

Architecture:

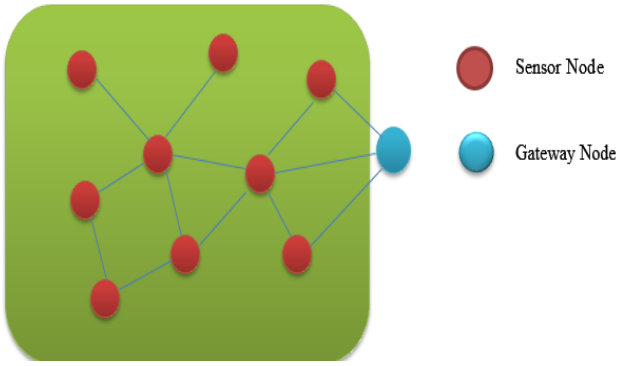

Fig 1: Architecture of WSN

In this architecture section an automatic irrigation monitoring and controlling system using wireless sensor network is established. The entire farm is divided into small section by keeping in mind that the range of the Wi-Fi employed on the nodes for communication. Here we observe that the communication is been done via nodes so there are gateway nodes and sensor nodes. All the data is send through the sensor nodes to the gateway node.

Now the WSN are distributed properly so the communication is spread over the entire field. This networks are used in many industrial and consumer applications, such as industrial process control and monitoring. So this architecture is widely used in different fields for different operations and have used it for agriculture field to check the scarcity of the water level in the field.

Proposed system:

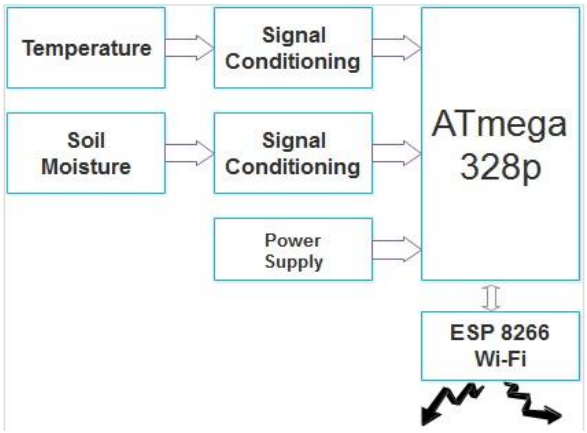

Fig 2: Sensor Node

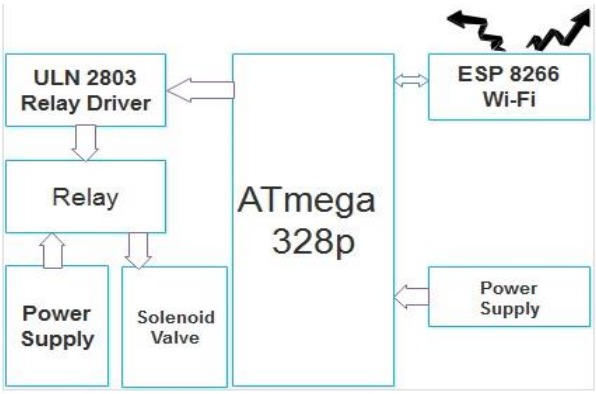

Fig 3: Valve Controlling Node

The above figure shows block diagram of sensor node and valve controlling node. In the sensor node there are two sensors: temperature and soil moisture sensor. Temperature sensor senses the temperature and soil moisture sensor senses the moisture contents in the soil.

In the program, threshold level is set. If the signal coming from sensors is above threshold then the sensor node send request to the valve controlling node to turn ON the solenoid valve for that particular area. Now according to program the solenoid valves will get activated by valve controlling node and then the water supply will start to that area from where the signal have arrived. Output of sensor is not exactly matching to that of input ADC .To calibrate these values from sensor, amplification with respective gain is required. This is achieved by OP-amp based signal conditioning. So here internally signal conditioning process is been done. Signal conditioning is most important for achieving step resolution with respect to ADC bit resolution. For ATmega 328p – 10 bit ADC resolution is possible. So we have use microcontroller ATmega 328p.For communication between nodes using the ESP 8266 advanced Wi-Fi module is used. This Wi-Fi module is advanced Wi-Fi module which has ability to connect multiple Wi-Fi and also we can feed program to that model.

In this protocol, there are 3 sensor nodes and 1 valve controlling node. Initially for all 3 sensor nodes, when the soil moisture sensor is deep into the dry soil then sensor senses that there is less water in that area so the signal is send to the valve controlling node. Then it open the valves and the water supply is given to the area where the water is less. So it seems that the signal is passed to the valve controlling node and the relay is ON and water supply is started.

Figure 4 shown, when the soil moisture sensor is deep into the wet soil. Then first relay get OFF as shown in figure 5 and valve get OFF for node 1 area. Same as for node 3 and node 4 as shown in figure 7 and figure 9. Placing the nodes by keeping in mind that the limited range of Wi-Fi. So placing the sensor node 3 and sensor node 4 out of the range of valve controlling node.

SOFTWARE:

1. Algorithm 1: Sensor node 1

    1. Initialize AP

    2. Start web server

    3. Wait for request

        If request

        Send Analog sensor data

        Goto 3

2. Algorithm 2: Sensor node 2 & 3

    1. Initialize station mode

    2. Connect to AP using SSID & PSWD

    3. Start web server

    4. Wait for request

If request

Send Analog sensor data

3. Algorithm 3: Main node

1. Initialize station mode

2. Connect to AP using SSID & PSWD

3. I. Send request to sensor node 1 using IP

II. Receive data

If data value < Threshold

Turn ON relay

else

Turn OFF relay

4. I. Send request to sensor node 2 using IP

II. Receive data

If data value < Threshold

Turn ON relay

else

Turn OFF relay

5. I. Send request to sensor node 3 using IP

II. Receive data

If data value < Threshold

Turn ON relay

else

Turn OFF relay

Result:

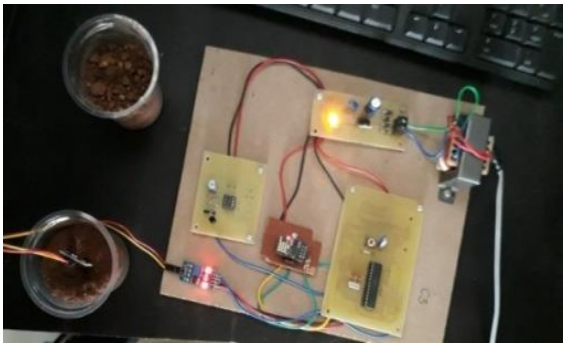

Fig 4: Sensor Node 1

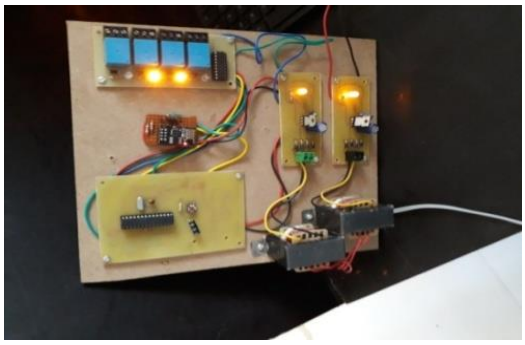

Fig 5: Valve Controlling Node

Fig 6: Sensor Node 2

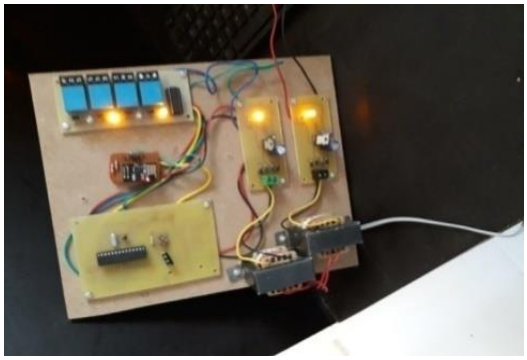

Fig 7: Valve Controlling Node

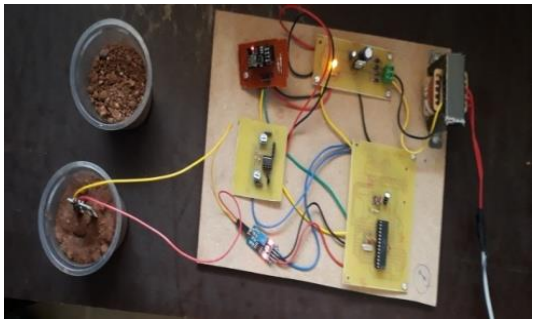

Fig 8: Sensor Node 3

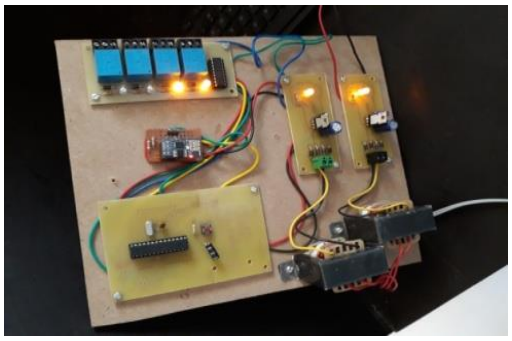

Fig 9: Valve Controlling Node

Conclusion:

In this project, we have studied the concept of WSN, where we came across that this project is quite helpful for farmers. This project will reduce farmer's workload such as complete monitoring of water for crops. Here proper water supply is given to the every corner of the field as requirement. This also reduces the wastage of water. As well the crops like Ginger, Turmeric etc. where proper water supply needed, this project is more essential. So we have developed this system such a way that this will be suitable for farmers and crops for their better result. This way this automatic irrigation system will make farming smart.

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4) CAWIS: Context Aware Wireless Irrigation System Divya P1, Surbhi Sonkiya2, Preeti Das2, Manjusha V. V.2, Maneesha

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