Enhancing rural development & agriculture water management by controlling irrigation automatically by using WSN

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Abstract: The most important part of the agriculture system is the moisture content & the fertility of the soil. The total irrigation system depends on these two factors. If these two factors are controlled productivity could be increased. Today in India the major problems are shortage of water due to scanty rainfall & the farmers lack access to irrigation techniques. Due to these the crop yields are highly unreliable. Also the farmers depend on prediction values of various factors such as weather, water, soil, etc. After measuring soil and water constituents the productivity could be increased. In this paper we are using two different techniques to measure soil fertility. After measuring soil fertility we propose a system of automatic drip irrigation through microprocessor to measure the moisture in soil.

Keywords: soil fertility, drip irrigation, moisture content.

Introduction:

Today, India ranks second worldwide in farm output. The share of agriculture employment is about 67%. Agricultural practices are neither economically nor environmentally sustainable and India's yields for many agricultural commodities are low. So there is a great need to modernize the conventional agricultural practices for the better productivity. Due to unplanned use of water the ground water level is decreasing day by day .lack of rains and scarcity of land water also results in decrement in volume of water on earth. In present drip irrigation system water is provided to root zone of plants drop by drop which results in saving of huge amount of water. The objective of the system is to a) conserve energy & water resources b) handles the system manually and automatically c) detects the level of water d) builds such system which enhances crop productivity e) learns selection methods of irrigation based on different parameter. But the growing researches and experiments in this field hasforced us to look at the brighter side of the technology inagriculture. Today large mechanized farms in developed countries use a combination of technologies like in field.

The sensor network technology can help the farmers in different ways:

Simulation models of crops, pests, diseases and farming operations are important tools for required information. It helps in calculating the water needs of the crops during growing period. The environment monitoring data provided over time and space by sensors can be used to validate and calibrate existing models. Farmers can monitor in real time the field conditions. This all can help them to take better decisions on crops, moisture conditions, climatic changes, water conditions, etc. The engineers and researchers can help the illiterate farmers by using maps and graphs drawn from the collected data which could help them in taking better decisions regarding their fields.

Present irrigation system

Surface irrigation: It is defined as a most common form of irrigation throughout the world which is practiced in many areas for thousands of years. In this the irrigation is practised on surface of land. Surface irrigation is also referred as flood irrigation which implies that the water distribution is uncontrolled and therefore it is inherently inefficient. These are of three types a) Level basin b) Furrow basin c) Border strip.

(a) Level basin:- In this technique the top end of the field is applied with water where it will flow
over the whole field. After the water reaches the end of field it starts run off to pond. It is a basic type of irrigation system which is used in our country at large basis. Water wastage is not good for dry area. It is used especially in rice cultivation.

b) Furrow irrigation basin: This irrigation basin is used in the production of vegetables. In this the whole field is not filled with water rather than water is applied in furrows. This saves water and also on the other hand the plant is not in directly in contact with water as some plants like production of vegetables are very sensitive. Furrows are sloping channels which are formed in the soil. This technique makes plant to take water from the roots and thus the plant is not in direct contact with water.

c) Border strip irrigation basin: In border strip irrigation the land is formed into strips which are levelled across the Narrow dimension. During irrigation, water is poured at the upper end of the border strip, and it is advanced down the strip. Border strip irrigation is one of the most complicated irrigation methods. It is suitable to irrigate all growing crops like wheat, barley, fodder, etc.

Water conservation measures

Water is an important resource and due to its scarcity it becomes even important to take measures for its conservation. The different ways to conserve water are: building bunds, planting trees to stop water from flushing away, strip cropping, crop rotation, planting of grasses for stabilizing bunds, etc. Now how much these different water conservation methods are effective can be calculated by using the soil-moisture readings taken by the sensor. Some modern techniques can be used to conserve water. They are also referred as micro strip irrigation.

Micro irrigation methods: Micro irrigation methods are precision method which has high water efficiency. In many parts of the country there is decline of irrigation water and conventional methods uses large quantity of water. To resolve this problem, micro irrigation methods are recently introduced in Indian agriculture. These methods save large amount of water hence increase in the crop productivity. Two main micro irrigation systems are (a) Drip irrigation (b) Sprinkler irrigation.

1. Drip irrigation: It is also called as micro irrigation or trickle irrigation. It is an efficient technique and is used in hot tropical conditions. It conserves water and fertilizer. It allows water to drip slowly to the root of plants through valves, pipes, tubing etc. It is done with the help of narrow hole in a pipe to deliver water directly to the base of the plant. The major disadvantage in surface irrigation was it results to water logging, if there is not proper drainage due to which crop gets flourished hence productivity gets affected. But in this we are providing water as requirement of drop therefore there is no problem of overwatering.

![Layout of drip irrigation](Image1)

2. Sprinkler irrigation: In sprinkler irrigation delivery of water is through a pressurized pipe network to the nozzles of sprinkler which spray the water into the air. In other words it is a type of artificial rain. The basic components of this irrigation are water source, pressure pump to pressurize the water, a pipe network to distribute the water over the field, the Sprinklers to spray the water over the ground and Valves to control the water flow.

![Sprinkler irrigation](Image2)

Advantages of micro irrigation:
(a) It saves water due to possibility of using saline water.
(b) Efficient and welfare use of fertilizers.
(c) Installation is easy & flexibility in operation.
(d) Suits to all types of land terrain & also suitable to waste lands.
(e) Enhances plant growth and yield & better quality of produce.
(f) Saves labour works.

Drip irrigation using wireless techniques:

(1) Zigbee technique for drip irrigation [1]:
This system is based on soil identification which consists of Zigbee module for communications purpose. In order to produce more crop per drop drip irrigation is used. Soil moisture sensor measures the moisture of soil. Here we use three sensors to monitor the three layers of soil. The output is recorded and is generated by microcontroller. If the moisture content of soil is high then valve unit remains closed and if it is dry, then valve unit remained open. The indicator indicates it. Microcontroller controls the operation of motor. Microcontroller sends this data to computer through ZIGBEE.Zigbee is a low cost, low power, wireless mesh network standard. Low power uses, allows longer life. Zigbee network layer natively supports both star and tree network and generic mesh network. Zigbee technique is one of the new techniques in drip irrigation. It is real time feedback control system which monitors the moisture content of soil. This is a modernize technique which is used over a large agriculture land. Zigbee is one new technology that is used in agriculture sector.

[Figure3. Architecture of ZIGBEE module for drip irrigation.]

(2) Precision agriculture by WSN [2]: It is the means for observing, accessing & controlling the new agricultural work or practices. It defines the site-specific crop management i.e. to study the soil, crops& climate of the field, use of fertilizers & pesticides over the field. Humidity is an important factor in development of disease. Temperature & weather are also the factors of disease therefore to monitor the risk of potato field, a wireless sensor are installed. The farmer should treat the field when there is a risk of disease in the crop. A total 150 sensors (T NODES) are installed to monitor the crop. NODES are equipped with sensors to measure temp & humidity. TNODES are installed at 75cm of height .This also measures the groundwater table height. A NODE records the temp & humidity every minute & sends once per minute. To save energy during transmission it is minimized by data encoding. Data collected by TNODES is gathered at field called gateway. It is transferred via Wi-Fi to P-C for data logging or collections. Lofar gateway is connected via wire to internet & data is then uploaded to servers” power where it is distributed to other servers.

IRRIGATION SYSTEM AUTOMATICALLY BY USING GSM- BLUETOOTH FOR REAL TIME MONITORING OF CROPS [3]:
In past years, automatic plant irrigator has played a vital role in enhancing the productivity of agriculture & to monitor the agricultural practices. This technique of irrigation proposes an economic as well as automatic irrigation system which is based on wireless sensors with GSM-BLUETOOTH for control of irrigation & real-time monitoring of agriculture. The sensors which are installed for real time monitoring of crops are controlled via SMS using a GSM module. This SMS is shared by BLUETOOTH or GSM technique interfaced with the main microcontroller chip. The above microcontroller controls the desired operation at the farmland. Above system also informs about temp. Rise,
concentration of CO2 in soil, moisture content of soil to the farmers mobile via SMS through GSM-BLUETOOTH module & accordingly the actions are taken by the farmers. The above system includes an 8-bit microcontroller chip (Atmega64), a GSM and Bluetooth module as well as RS232 interface (fig 10). Here we are using microcontroller which is interfaced with different sensors to monitor the crops. The A/D converter converts the analog data of sensors to digital data. EEPROM records the data provided by sensors. This data is analyzed by microcontroller & according a sms is sent to subscriber mobile through GSM (for distance control) & Bluetooth (for nearest control). When a user sends an SMS requesting the status of devices and measured value by the sensors, the GSM module sends the data stored in EEPROM as a response via SMSs.

**Proposed system:**

**Soil fertility measuring devices (4):**

To measure the fertility of different types of soil we have different devices. If we introduce a wireless system to drip irrigation then it becomes a boon for the production of agriculture. Now, if we make focus on the different types of soil especially in the Bundelkhand area of Uttar Pradesh the percentage of moisture in the soil & the fertility percentage of the soil is almost to zero. The percentage of phosphorus, nitrogen & potassium which are the most important ingredients of soil are very less.

There is a great need to check the fertility of soil so that a crop can be grown in that area. Before applying drip irrigation, to check the fertility of soil is of upmost importance.

**Rapidest soil fertility meter:**

This device has two metal prongs that are inserted into a soaking oil wet sample. The electric behaviour of the soil is shown on the meter. It has a switch on the side and by flipping a switch, indicates a ph. or overall fertility of soil. The attractive feature of this detector (fig.5) is that it tests a large sample of soil at one time. This device is easy to use and provide quick results.

**Ph. Tester:**

This ph. Tester (fig: 6) is a very useful tester which works against a buffer reference solution. It provides a ph. value of 7 or small then 7. This tester test according to prescribed value of ph. level.

**Automatic plant irrigator using 8085 microprocessor (5):**

The proposed system of drip irrigation is consists of sensor using op-am LM324. The function of op-am is same as comparator. Here we are using two stiff cu wires to sense the moisture of soil. The whole system is controlled is controlled is microprocessor. The sensors are monitored by...
microprocessor through IC8255. The sensor will sense the moisture content of soil. If soil is dry then microprocessor will switch on motor and motor will be switched off when the soil goes wet. We are using microprocessor 8085 and IC8255.

Fig 7: circuit diagram

Fig 8: block diagram

CONCLUSION

In this paper we are using fertility meter and ph. meter to determine the percentage of potassium, phosphorus, nitrogen which are the most important ingredients of soil. Now after measuring fertility of soil, we have implanted the automatic plant irrigator for DRIP irrigation through wireless. Both techniques will help to judge fertility and moisture content of soil. The sensor network technology will help the farmers to know the exact values of the requirements that they need to improve the crop productivity. It will help them in taking better decisions at the right time. This will save their time and labor also. The basic aim here is to transport the Indian farmer from prediction to the exact values which are beneficial for their farms.

REFERENCES


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