International Journal of Soft Computing and Engineering (IJSCE)
ISSN: 2231-2307, Volume-3, Issue-1, March 2013

Control of Irrigation Automatically By Using Wireless Sensor Network

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Abstract: In the field of agriculture the most important part is: firstly, to get the information about the fertility of soil and secondly moisture content of soil. After measuring these two factors a farmer can start sowing of seeds. In this paper we are giving the brief outline about different techniques to measure soil fertility in order to check the productivity of crop. We are using here two devices to measure the constituents (potassium, phosphorus, nitrogen) of soil. After measuring fertility, we are proposing a system of automatic drip irrigation through microprocessor to measure the moisture of soil.

Keywords: Fertility, Microprocessor, Drip irrigation.

I. INTRODUCTION

In India, where 60-70% economy depends on agriculture, 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.

Present irrigation system

1. 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. 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.

Manuscript received on March 2013.

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Fig 1. Level basin flood irrigation

b) **Furrow irrigation basin**: This irrigation basin is used in the production of vegetables. It has several advantages that whole field is not filled with water rather than water is applied in furrows. This saves water at the same time and on the other hand the plant is not in direct contact with water as some plants like production of Vegetables are very sensitive to pounded water. Furrows are sloping channels which are formed in the soil. This technique makes plant to get water in its root zone and therefore plant is not in direct contact with water. Figure 2

Fig 2.Furrow irrigation.

c) **Border strip irrigation basin**: In border strip irrigation which uses land formed into strips which is leveled across the Narrow dimension i.e. width and the sloping is done in long dimensions i.e. length, is Formed. 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. Figure 3

Fig 3.Border irrigation.

Disadvantages of using conventional irrigation methods: - Large amount of water is used in above irrigation techniques. Efficient and welfare use of fertilizers is not possible. Requires large man work. Net yield or productivity is also not

high. Problems related to soil erosion are major problem. Substantial amount of ground water goes waste. Problem of water logging in fields.

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: To keep water conservation move, we can move forward with drip irrigation. It is also named as micro irrigation or trickle irrigation. It is an efficient technique which is primarily used in hot tropical conditions . It conserves water and fertilizer .It allow water to drip slowly to the root of plants through valves, pipes, tubing etc. It is done with the help of narrow .It is done with the help of narrow tubes which delivers water directly to the base of the plant. A study of land topography, soil, water conservation is needed to determine most suitable drip irrigation system. 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.

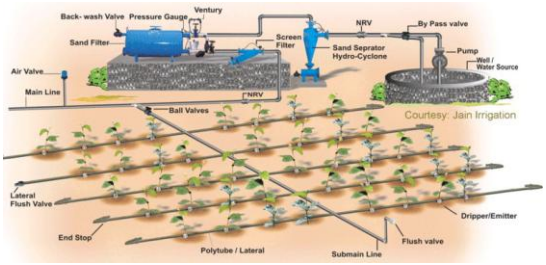

Figure 4. Layout of drip irrigation

3. 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 we can say that, 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.

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) Weed growth is less.
(g) Saves labor works.
(h) No soil erosion which saves land.
(i)Minimum diseases and pest control.

figure5. *Sprinkler irrigation.*

Drip irrigation using wireless techniques

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 sense the moisture of soil. We are using three sensors to monitor the three layers of soil. The output of the sensors is recorded by microcontroller and output 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 whether the soil is dry or having moisture content. Microcontroller controls the operation of motor. Microcontroller sends this data to computer through ZIGBEE. [1]

Zigbee is a low cost, low power, wireless mesh network standard .Low power uses, allows longerlife. Zigbee chip vendors typically cell integrated radios and microcontrollers with between 60 kb and 256 kb flash memory.Zigbee network layer natively supports both star and tree network and generic mesh network. Zigbee operates in industrial, scientific and medical and radio bands: 915 MHz in USA and Australia and 2.4 GHz in most jurisdictions worldwide. 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. Figure 6

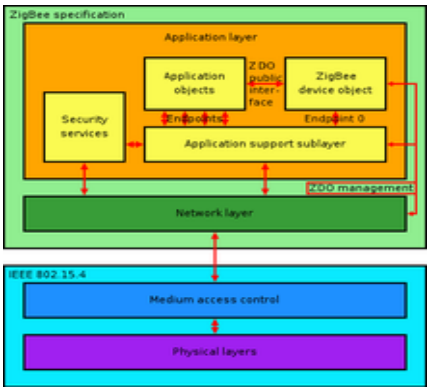

Figure 6. Architecture of ZIGBEE module for drip irrigation.

Drip irrigation automation supported by soil moisture sensors through wireless application [2]:

It describes an application of a wireless sensor network for low-cost wireless controlled irrigation solution and real time monitoring of water content of soil**.** The data is recorded by using solar energy for the wireless station for the purpose of control of valves to do irrigation. We have generally three main units:-Base station unit, Valve unit, Sensor unit (fig.8). These all three units record the moisture content of soil & also provide the efficient use of fresh water resources.

This above technique is based on 'MORE CROP PER DROP'.A wireless- sensor based irrigation control system is

used to maximize the efficiency of crop production. . This developed irrigation method can be used in the production of kharif crops in semi-arid areas. In earlier method they have used Bluetooth technology but here we are using more wired technology. The proposed system has been realized in form of 3 portable units. These are named as base station system (BSS), valve system (VS) and sensor system (SS). All of the systems are involved in UDEA brand 434 MHz RF module, 7 V, 1.8 W solar panel (s) and low power Microchip controller Decagon chip. PIC18F452 micro brand soil moisture is seen in SS which sends data of soil moisture (fig.7) the data to base received station unit's evaluates from SS and decides which part of area must be irrigated and which types of signals must be sent as open or close information to valve unit. In the developed system 25-124 soil moisture sensor has been used to measure moisture content of soil.250-124 requires 12 vdc+20% @ 40ma. The MCU of ATMEL Company which has specification as 20mz oscillator frequency, internal RAM of 768 bytes, 256 bytes EEPROM & 40 pin data input package with 34 I/O pins. Wireless module model named as ufm-m12 markets by udea technology INC. It is used for soil moisture sensor. A 434 MHz low noise wireless system is also used. Valve unit has been connected with wireless module. It is programmed by RD6 pin of micro controller.

Fig.7: soil moisture sensor

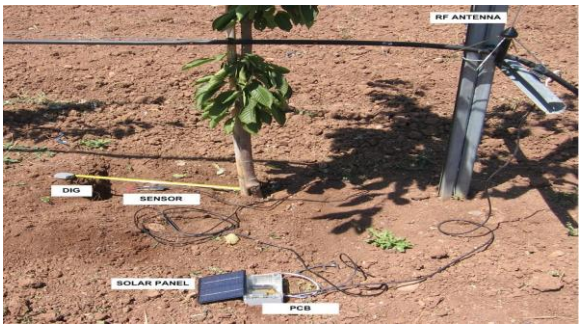

Fig.8: Drip irrigation using wireless sensors networks

Precision agriculture by Wireless sensor networks [3]:

Its main focus is to provide 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.

Lofar Agro Project was started to deal with a fungal disease which enter through various sources. This disease is called Phytophtora in a potato 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 (fig.9) 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.

Fig.9: T-node sensor (lofar agro mote)

II. IRRIGATION SYSTEM AUTOMATICALLY BY USING GSM- BLUETOOTH FOR REAL TIME MONITORING OF CROPS [4]:

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, conc. 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.

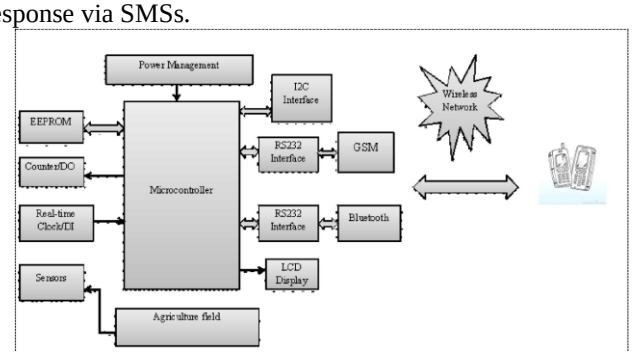

Fig 10: Block Diagram of Automatic Irrigation system using GSM-Bluetooth.

Proposed system:

Soil fertility measuring devices (6):

To measure the fertility of different types of soil we have different devices. If we see above research papers, then we will determine that the drip irrigation is a necessary technique to make the soil full of moisture needed for the generation of crop .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 behavior 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.11) is that it tests a large sample of soil at one time. This device is easy to use and provide quick results

Fig11: Rapidest soil fertility meter

Ph. Tester:

This ph. Tester (fig: 12) 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.

Fig12:ph. tester

Automatic plant irrigator using 8085 microprocessor (7):

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 stif cu wires to sense the moisture of soil. The whole systemis 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 andIC8255.

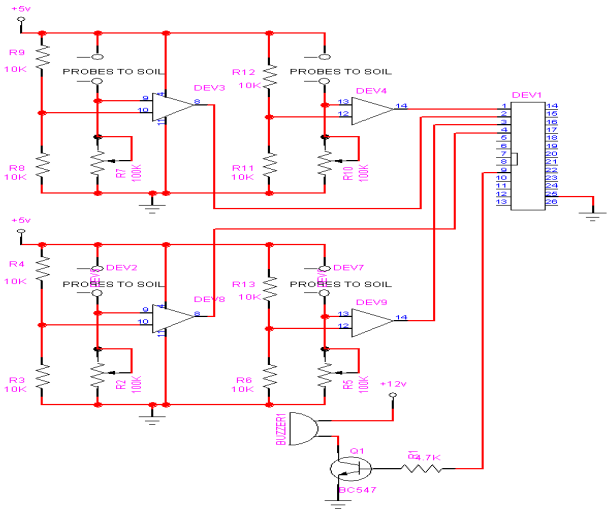

Fig 13: circuit diagram

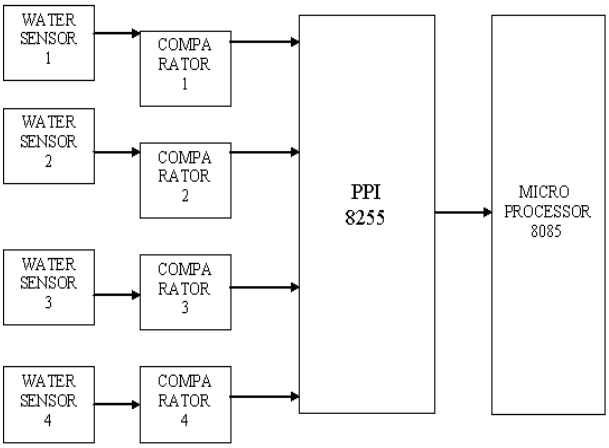

Fig 14: block diagram

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. This application of sensor-based irrigation has some advantages such as preventing moisture stress of trees, diminishing of excessive water usage, ensuring of rapid growing weeds, measuring fertility of soil.

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