

Automatic Irrigation Control by using wireless sensor networks

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ABSTRACT

In the field of agriculture, use of proper method of irrigation is important and it is well known that irrigation by drip is very economical and efficient. In the conventional drip irrigation system, the farmer has to keep watch on irrigation timetable, which is different for different crops. The purpose of this paper is to provide more facility in agriculture field by using Zigbee. Paper describes an application of a wireless sensor network for low-cost wireless controlled and monitored irrigation solution. The developed irrigation method removes the need for workmanship for flooding irrigation. Efficient water management plays an important role in the irrigated agricultural cropping systems.

KEYWORDS: surface, drip, irrigation, ZigBee, wireless sensor.

INTRODUCTION:

In India, where the economy is mainly base on agriculture and the climatic conditions are isotropic and are not able to make full use of agricultural resources. The main reason is the lack of rains and scarcity of land reservoir water. The continuous extraction of water from earth is reducing the water level due to which lot of land is coming slowly in the zones of un-irrigated land. Another very important reason of this is due to unplanned use of water due to which a significant amount of water goes waste. In the modern drip irrigation systems, the most significant advantage is that water is supplied near the root zone of the plants drip by drip due to which a large quantity of water is saved, at the present era, the farmers have been using irrigation technique in India through the manual control in which the farmers irrigate the land at the regular intervals. This process sometimes consumes more water or sometimes the water reaches late due to which the crops get dried. Water deficiency can be detrimental to plants before visible wilting occurs. Slowed growth rate, lighter weight fruit follows slight water deficiency. This problem can be perfectly rectified if farmers use automatic irrigation system by using ZigBee module.

OBJECTIVE:

- To save water, energy and man power in the agriculture sector
- Handle the system manually as well as automatically
- Detect water level
- To design, build and test the system which will be economical, efficient and effort reducing of the former.

NEED OF THE PROJECT:

Irrigation is an artificial application of water to the soil. An irrigation system is a system that delivers water to an area where water is needed but not normally present in the required amounts. Generally, it is used for agriculture and landscaping purposes. The effectiveness of the irrigation is determined by a number of different factors, including the type of irrigation system and the conditions at its time of use. Additionally, irrigation also has other uses in crop production, which include protecting plants against frost, suppressing weed growing in gain fields and helping in preventing soil consideration. In contrast, agriculture that relies only on direct rainfall is referred to as rain-fed or dry and farming.

Types of irrigation: Surface irrigation:



Fig. Level basin flood irrigation

Surface irrigation is defined as the group of application techniques where water is applied and distributed over the soil surface by gravity. It is by far the most common form of irrigation throughout the world and has been practiced in many areas virtually unchanged for thousands of years. Surface irrigation is often referred to as flood irrigation, implying that the water distribution is uncontrolled and therefore, inherently inefficient. In reality, some of the irrigation practices grouped under this name involve a significant degree of management (for example surge irrigation). Surface irrigation comes in three major types; level basin, furrow and border strip. The process of surface irrigation can be described using four phases. As water is applied to the top end of the field it will flow or advance over the field length. The advance phase refers to that length of time as water is applied to the top end of the field and

flows or advances over the field length. After the water reaches the end of the field it will either run-off or start to pond. The period of time between the end of the advance phase and the shut-off of the inflow is termed the wetting, ponding or storage phase. As the inflow ceases the water will continue to runoff and infiltrate until the entire field is drained. The depletion phase is that short period of time after cut-off when the length of the field is still submerged. The recession phase describes the time period while the water front is retreating towards the downstream end of the field. The depth of water applied to any point in the field is a function of the opportunity time, the length of time for which water is present on the soil surface.

Drip irrigation:

Drip irrigation, also known as trickle irrigation or micro irrigation or localized irrigation, is an irrigation method which saves water and fertilizer by allowing water to drip slowly to the roots of plants, either onto the soil surface or directly onto the root zone, through a network of valves, pipes, tubing, and emitter. It is done with the help of narrow tubes which delivers water directly to the base of the plant. Modern drip irrigation has arguably become the world's most valued innovation in agriculture since the invention of the impact sprinkler in the 1930s, which offered the first practical alternative to surface irrigation. Drip irrigation may also use devices called micro-spray heads, which spray water in a small area, instead of dripping emitters. These are generally used on tree and vine crops with wider root zones. Careful study of all the relevant factors like land topography, soil, water, crop and agro-climatic conditions are needed to determine the most suitable drip irrigation system and components to be used in a specific installation.

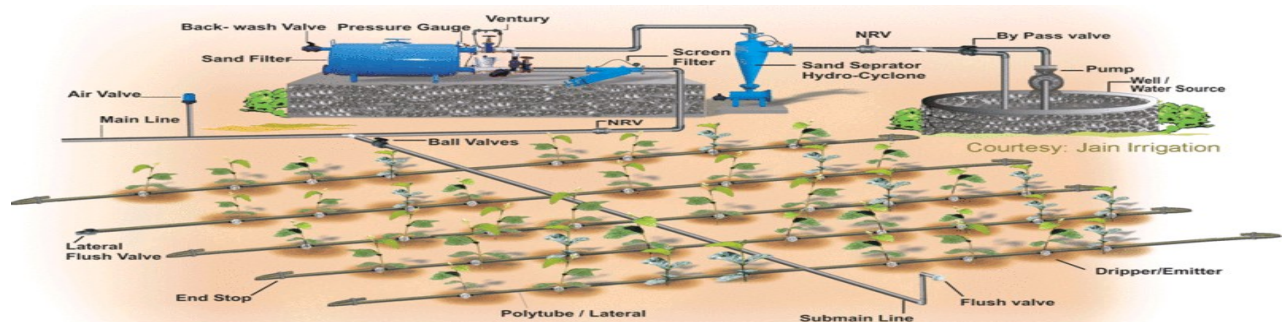


Fig. layout drip irrigation

Drip tape causes extra cleanup costs after harvest. Have needed to plan for drip tape winding, disposal, recycling or reuse. Waste of water, time & harvest, if not installed properly. These systems require careful study of all the relevant factors like land topography, soil, water, crop and agro-climatic conditions, and suitability of drip irrigation system and its components. The major disadvantage of surface irrigation is that it tends to lead to water logging and soil salinity if there are no provisions for adequate drainage. Another disadvantage is that it tends to be labour intensive. Due to surface irrigation overwatering is occurred. Due to over watering can cause water logging and reduce root growth by cooling the soil. Hence crop quality. In manual control technique of irrigation moisture level of soil is not taken into account. But in this system we are providing the water as per requirement of crops. This avoids the overwatering and its side effects.

LIMITATIONS OF EXISTING IRRIGATION SYSTEM:

The existing projects have not considered moisture level of soil they are time based. Also user data communication .also user has no idea about the status of motor and condition of water level from area.

SOLUTION:

The above limitations are properly avoided in the soil irrigation system. The status of all parameters such as motor ON/OFF, water level etc. by using zigbee module we can transmit and receive the data over long distance. We can control motor by using microcontroller. There are many different technologies available for wireless communication useful in application related to irrigation in farm field that is limited largely by the governmental allocation of communication bands. The major types of wireless communication are radio frequency (RF) communication, personal area networks (PAN)--both narrow band and ultra wide band (UWB), local area networks (LAN), cellular networks, and satellite networks are used. Irrigation control with the zigbee in agricultural areas has a crucial importance. Because of highly increasing demand for freshwater, optimal usage of water resources has been provided with greater extent by automation technology.

ZIGBEE system is efficient for water management in the irrigated agricultural cropping systems. The system is based on soil condition identification and consists of zigbee module for communication purpose. . In order to produce “More crop per drop”. Site-

specific wireless ZigBee-based irrigation control system is a potential solution to optimize yields and maximize water use efficiency.

BLOCK DIAGRAM:

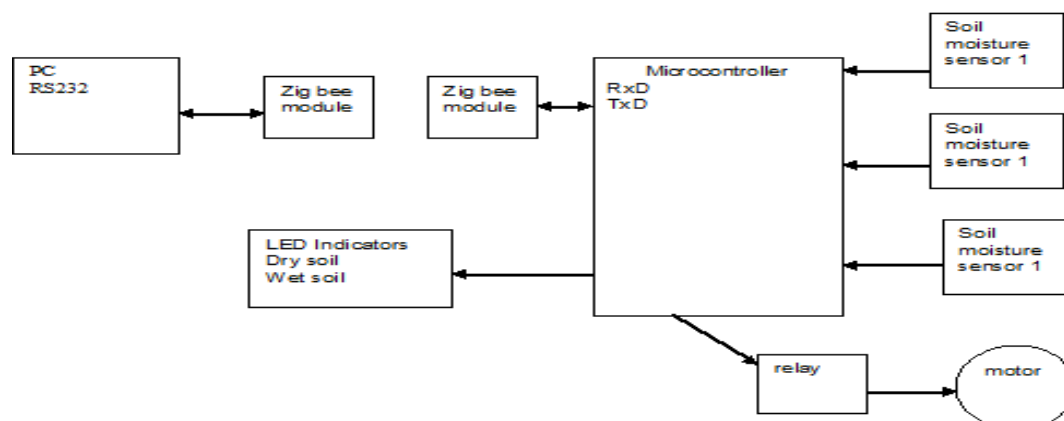


Fig.

Block diagram of agricultural irrigation system

WORKING:

Soil moisture sensing network is used to monitor the moisture contained in soil. Three different sensors are used to monitor three layers of soil. And according to that further action is taken by microcontroller as the output of network is given to the microcontroller. Indicator indicates whether the soil is dry or wet. Microcontroller is the heart of the system; it controls the overall irrigation system. It takes the input from moisture sensor 1, 2, 3 etc. & according to the written program it turns ON or OFF the motor pump. It also indicates the condition of soil. Also it provides the data to the PC through zigbee module. When soil is dry motor is on and when soil is wet motor is off. Thus microcontroller controls the operation of motor. Zigbee module is a communication technology just like a Bluetooth but different that it is a full duplex communication. It is used here to have wireless link between PC & the main irrigation system. So that data can be logged into PC. In our project we have one master and one slave device. AC or DC motor can be used for whole system. On the basis of soil moisture detection, motor ON/OFF working will be done. Provision of water and considering the need of water to the crop is done by controlling motor. Along with this the valves are made on depending on the state of the soil. LCD is also used at field .It indicates message from the microcontroller soil state, motor state

NEED OF ZIGBEE IN AGRICULTURE FIELD:

ZigBee is an established set of specifications for wireless personal area networking (WPAN), i.e. digital radio connections between computers and related devices. ZigBee provides specifications for devices that have low data rates, consume very low power and are thus characterized by long battery life. ZigBee makes possible completely networked homes where all devices are able to communicate and be controlled by a single unit.

ZIGBEE:

ZigBee is a low-cost, low-power, wireless mesh network standard. The low cost allows the technology to be widely deployed in wireless control and monitoring applications. Low power-usage allows longer life with smaller batteries. Mesh networking provides high reliability and more extensive range. ZigBee chip vendors typically sell integrated radios and microcontrollers with between 60 KB and 256 KB flash memory. ZigBee operates in the industrial, scientific and medical ([ISM](#)) radio bands; 868 MHz in Europe, 915 MHz in the USA and Australia, and 2.4 GHz in most jurisdictions worldwide. Data transmission rates vary from 20 to 900 kilobits/second. The ZigBee network layer natively supports both [star](#) and [tree](#) typical networks, and generic mesh networks. Every network must have one coordinator device, tasked with its creation, the control of its parameters and basic maintenance. Within star networks, the coordinator must be the central node. Both trees and meshes allow the use of ZigBee [routers](#) to extend communication at the network level. ZigBee builds upon the [physical layer](#) and [medium access control](#) defined in IEEE standard 802.15.4(2003 version) for low-rate [WPANs](#). The specification goes on to complete the standard by adding four main components: network layer, application layer, *Zigbee device objects* (ZDOs) and manufacturer-defined application objects which allow for customization and favour total integration.

MERITS:

The system becomes advantageous because -

1. Moisture level of soil is measured. So that we can provide water as per requirement of the soil. It prevents water clogging of soil.
2. Valves are controlled in our system. Therefore labour is not required for valve controlling;
3. Message is sent to the user's pc so he can understand the moisture level and user can handle the situation also at the distant location.

4. Drip irrigation has ability to put water directly at the root of the plant as per need. This improves crop quality.
5. Drip line reduces the amount of total runoff, saving water resource as well as home owner's money on their water bill.

CONCLUSION:

The ZigBee based drip irrigation system proves to be a real time feedback control system which monitors and controls all the activities of drip irrigation system efficiently. This will modernize the agriculture field and irrigation control by using ZigBee is one of the good technologies for controlling irrigation over large agricultural sector areas for growing of crops.

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