WSN Application: Intelligent Drip Irrigation System Through Moisture and Temperature Sensors

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Abstract
In the field of agriculture two things are important, first the fertility of the soil and second, moisture content present in the soil. These two factors decide that how well will be the growth of seeds or content present in the soil are sufficient for the showing of seeds. Moisture of the soil depends on how much content of water is present in soil. Moister present in soil is dependent on type land and climates conditions present wither rainy region, dry region, and hot tropical. In recent time there is advancement in technology used in agriculture changing the phase of agriculture. Irrigation of farming is completely different from ancient method of irrigation as new method like drip irrigation is used by farmers. Farmer use traditional method of irrigation waste lot of water, up to 60% and Drip irrigation helps to reduce this percentage of waste water. Drip Method using present day are automatic, wireless sensors, all based on microcontroller monitored by remote from the base station. These wireless sensors collect all the data related to soil moisture, fertility, and chemical ingredient, requirement of pesticides and after analyzing this gathered information alert for a better plan for irrigation for particular crop.

I. Introduction
An artificial process of watering to field (crop) is known as Irrigation. In India, mostly farmer depends on monsoon for the requirement of water for farming that depend on nature and now system of nature is changed due to pollution or global warming that’s why there is need of developing automatic and efficient method of irrigation. Near about 50% of total cultivated area in India is under irrigation and remaining depends upon rain or there is no advanced method of irrigation are followed by farmers while irrigating through ancient way requires a lot water that is not present in efficient amount now(less than 2.5% water is usable while 71% of total surface is covered with water). When farmer do watering to the field, they don’t know for how much time they keep motor on or they don’t have any data of soil moisture or don’t have any idea that for how much time let the water flow in the field. In drip system watering is done by drip method not like sprinkle system. It is well known as micro irrigation and tickle irrigation. This technique is mainly used in hot tropical conditions. It allows water to the root of plant slowly through valves, pipe, tubing etc. By this method nearly 50% water could be saved if this technique is implemented everywhere and water problem can be overcome up to an extent. New developed Drip irrigation method also well-known as micro irrigation and an irrigation method which reduced the use of water, fertilizer by allowing water gradually by drip to the roots of plants, either onto the top soil surface or straight to the root region due to which a huge amount of water is saved, also the fertilizer which comes to the plant with the water. Newly developed method of irrigation helps a lot to overcome all these problems and focus on use per drop for crop, no extra water or effort is required with saving of money and make farmers more efficient, they know how to get maximum productivity while using the minimum resources. In last year’s with advancement in technology, a number of research have been done for the automation of agriculture field and get better result, Zigbee is a popular micro irrigation method completely technical based method of irrigation.[1]

II. Problems Faced by Agriculture
Agriculture in India developing day by day, in spite of its decline in country's GDP contribution, the improvement and growth in agriculture area cannot be ignored. Still Indian agriculture sector is facing problems, some are natural while some are man made a described following:

Undersized and Uneven land holdings: The large quantity of total sown region in India is divided into cost-effectively non-viable small and scattered land holdings. Our established inheritance laws are totally responsible for the partition of agricultural area into small fragment. The allocation of field is not consolidating one, but its way of consolidation is fragmented. dissimilar holdings has diverse property like
its fertility, composition, texture and many other factors which determine the production of crop in that particular area.

Lack of high-quality Seeds for poor peasants: Seed is the significant factor of crop growing; it is the basic input to attain higher crop yields and continued growth in farming production. Unluckily, high-quality seeds are not in reach of greater part of farmers because of the very high prices of seeds.

Difficulty in Irrigation: Indian farming is mainly based on monsoon, which is doubtful, unpredictable and irregular that’s why need an suitable alternate irrigation system. Though India is 2nd leading irrigated nation in the world after China, only 1/3rd of the cropped region is under irrigation. Indian farmers still following the traditional way of irrigation like surface level irrigation, furrow irrigation as shown in figure:[2]

Mechanization and Modernization lack: majority of the farmers still using the usual apparatus for farming (sowing, irrigating, thinning and harvesting). Minor and small farmers are using much of the individual effort, which outcome in the wastage of human being hard work, time wasting and in low yields per capita labour force. However flourishing effort are made by Indian government to promote, the farmers to adopt new technically sound agricultural equipments.

III. Present day agriculture and its scenario
Continuous and uniform growth of farming is the means of financial development and alleviation of poverty from the Rural India as agriculture sector is the back bone of Indian economy and a majority population depends on agriculture. There is no single lay down of objective situation for quick farming development and neither a particular set of actions of assure success. However it is probably to classify a common way and themes from success story. There are some primary means of improving production (field growth, change in productivity, and technical change) differ in significance and function of the stage reached in growth. Promise of field extension is limited as more area is farmed extension becomes of declining importance but changes in both production mix and technology maintain their importance through the whole the progress process and require a dynamic and flexible sector. It is essential to offer suitable incentives to farmers and to make sure surroundings that permit them to respond to the incentives. Technology is a prime aspect contributing to enhance the farm output productivity in developing countries over the past half-century. Latest technique providing extra employment in rural areas attracted the
people. Use of technology is completely changing the scenario of the agriculture and farmers are adopting the new technology and using the latest equipment for farming that reduce the human labour with reduced time. Latest technologies for irrigation are introduced by Agriculture Department of country. These techniques are new in India and these have high water efficiency known as micro irrigation technique. Sprinkler system helped a lot in areas where water is major problem for agriculture, areas like Rajasthan. By this technique watering to field is easy and quite water saving. Watering by this technique is quite useful for crop because this is like asof surf

Drip irrigation system of watering latest and advanced method. It is well known as micro irrigation and tickle irrigation. This technique is mainly used in hot tropical conditions. In drip method only does the watering to the crop or plant root. It allows water to the root of plant slowly through valves, pipe, tubing etc. By this method nearly 50% water could be saved if this method is followed. A study of soil, land topography, water conservation is needed for better set up of drip system. There is no problem of over watering and get an enhance productivity.

![Figure 4: advanced machine used for farming](image1)

![Figure 5: sprinkler irrigation](image2)

![Figure 6: drip irrigation](image3)

**IV. Role of Technology in Agriculture**

Farming in India is done by traditional method and farmers don’t have any data regarding with soil, weather (temperature, pressure and humidity), fertility. There are so many another problem faced by farmers in agriculture field like crop pest, diseases, water supply, weather information, no connectivity with market, update about new breed and its farming technique, deficiency of updated instrument and educated farmers and many
other problems that can be overcome only with the adoption of advanced technology.

**Crop monitoring through wireless sensor network:** Use of Information technology introduced a new concept in agriculture as Precision Agriculture. The precision framing adoption is a cyclic process of data gathering, diagnostic, data examination, accuracy field operation and evaluation. For state and condition monitoring of crop there is visual inspection, color estimation and mold localization. For monitoring the conditions wireless sensor network is preferred because it provides results in real time and there is no limitations of distance and physical barrier, as data provided is in real time. The use of remote controlled helicopter that is known as Unmanned Ariel Vehicle (UAV, developed by Japan for agriculture) is widely used for spraying purpose and also for inspection of field with high precision camera.[3]

![Figure 7: Monitoring of Field by Unmanned Ariel vehicle](image)

**Zigbee technology for irrigation:** A sensor helps to examine the field without manpower and helps a lot in precision agriculture. There is many type of module of sensors are developed in wireless sensor network. WSN technology needs low power for their operation and easy to operate & install. A base station for the control of this whole network that is known as gateway( different network are connected through gateway) is required that connects with all sensors installed through radio link. Maintenance of wireless network is also low and speed of communication is high. Wireless sensors provide all the data regarding presser, temperature, humidity, soil data and other useful data in real time. Wireless technology can be used for field inspections, drip irrigation, water testing, soil fertility but zigbee is mainly used for drip irrigation and use every drop of water.[4]

![Figure 8: Zigbee technique for farming](image)

**V. Proposed model**

Earlier there were no such advanced equipment of measuring temperature and moisture was available. So farmers did not have any idea related to these aspects and did there farming work just by an idea, don’t know for how much time keep watering the crops or what temperature are required for particular crops. But now a days’ advance temperature and humidity sensors are available those sensors monitor these conditions and provide real time data to farmers. The improvement in wireless sensor network can be used for inspection of different circumstances in farming. Because of irregular ordinary distribution of rainfall it is not easy for farmers to observe and manage the supply of water to agriculture field in the whole farm or according to per requirement of the crops. Because of irregular conditions present like soil structure, different weather conditions, there is no ideal irrigation method and several times farmers suffer a finical loss due to wrong prediction of weather. Conventional wired connections exist many problems as it became quite bulky its area of monitor also become limited. This is the era of internet and advanced wireless communications, accept the advancement of wireless sensor network based on Zigbee, GPRS and Web...
Services designing a set of low cost and low power required for functioning. Wireless sensors are planted in field and connected to a hub that monitors these sensors. Figure 9: temperature sensor circuit layout

This hub is connected to base station from where farmer get all the calculated and real time data and came to know what the requirement of crop is or how much humidity is present or what temperature, pressure is, provide all the information that is helpful for crop growing and farmer should be aware of these. Circuit layout diagram of temperature sensor is as in figure; [5]

In this proposed model we are using three moisture sensors which are deployed in the farming field. These sensors are connected with ADC pins of ATMEGA16 [6] microcontroller. AT Mega is 16 MHz 16 kb 8 bit microcontroller of 40 pins with high performance and low power used for processing. It have on chip comparator, separate on chip Oscillator with programmable watchdog timer, separate Prescalar two bit 8 bit counter/timer, separate prescalar, compare and capture mode with One 16 bit timer/counter, real time counter with separate oscillator, 10 bit ADC with 8 channel. This microcontroller have some special feature like internal calibrated RC Oscillator, interrupt sources of internal and external, with six sleep mode as ADC noise reduction, Power save, power down stand by and extended stand by, Idle. Moisture sensors sense the moisture value of soil and transmit this analog data to ADC pins of microcontroller. These ADC pins converts analog data into digital data. This digital data is shown on LCD which is connected micro controller data pins. LCD used in circuit is LM016L LCD of 16 character * 2 line of Gray colour need a low power supply of +5 volts for its operations[7]. Its module size is 84W * 44H * 10.5T of very light weight of near about 35g with character pitch 3.55 mm. according to the moisture value of soil we control the motor which is connected with drip irrigation system pipeline. Instructions, which control motor, are sent through Zigbee module

Power supply: for the power supply circuit use U2 7805 that provides +5v that is required for circuit to operate with symmetric power supply (power supply that give positive, negative and ground polarities). For stabilization of 5v use the C1 and C2 of 10u. input voltage supply of 12v with output 5 volt.

Figure 10: power supply circuit

Reference
[4] Role of Zigbee Technology in Agriculture Sector, Alka Kalra, Rajiv Chechi, Dr. Rajesh Khanna.
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