

# Design of Wireless Sensor Node for Agriculture Field Monitoring

Honey Garg, Namit Gupta, Chintan Patel

**Abstract** – Indian economy is mainly based on agriculture. In today’s world due to global warming and climatic changes there is challenging situation in field of agriculture. Number of advance methods and technologies are coming in agriculture to reduce cost and improve total productivity. There is new concept of agriculture in controlled environment. This paper describes the monitoring technology of agriculture field which consist of WSN (wireless sensor network). This WSN is very suitable for agriculture information and irrigation system. Wireless technologies have been under rapid advance in the recent years. WSN is design for measure the some parameters like soil temperature, ph, humidity, electrical conductivity etc. It reduces the labor cost or provides convenient services to farmer.

**Keywords** – Agriculture Field, Irrigation, Microcontroller, Sensors, WSN.

## I. INTRODUCTION

Agriculture is the backbone of the Indian economy. The development of agriculture in terms of area of land under cultivation, use of modern equipment and financial assistance to the farmers is absolutely essential. India is to progress economically with all sectors of the population enjoying its agricultural effect. One of the major problems present today is the less knowledge of the soil content & types, less knowledge of the type of fertilizers to be added, the irrigation amount and pattern depending on the soil porosity and its water retention capacity. In the current Indian scenario analysis of soil to increase crop yields is not being used to a large extent primarily due to the cost involved and the inaccessibility of labs offering such testing facilities. Moreover due to small size of land holdings the procedure of sending soil samples to a far off lab and then taking decision does not seem economically viable.

The technological development in Wireless Sensor Networks made it possible to use in monitoring and control of Agriculture parameters in rural area. Due to uneven natural distribution of rain water it is very crucial for farmers to monitor and control the equal distribution of water to all crops in the whole farm or as per the requirement of the crop. There is no ideal irrigation method available which may be suitable for all weather conditions, soil structure and variety of crops cultures. It is observed that farmers have to bear huge financial loss because wrong prediction of weather and incorrect irrigation methods to crops.

## II. DESIGN OF SYSTEM

In WSN, number of nodes connect with each other through wireless channel and communicate with different

communication methods. Typical sensor nodes consist of microcontroller, sensor module, transceiver module and power supply.

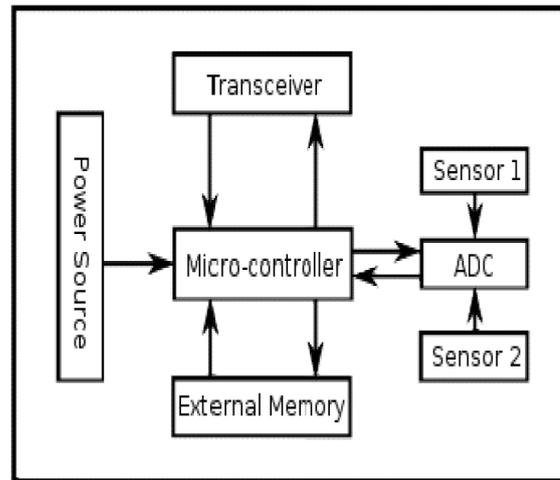


Fig.1. Sensor node

Firstly all the sensor nodes analysis the soil data and then send the analog signal to the microcontroller. After that, ADC converts the analog signal into digital form and then microcontroller send this data to LCD unit display. The data that transmitted to central control station unit is transmitted through RF transmitter. The data is then receive and display to control station receiver unit.

## III. NODE ARCHITECTURE

This section consist of sensors for agricultural parameters (soil temperature, ph, humidity, conductivity) transferring the data using transceiver from crop field to control station for decision making and finally actuation and control decision based on sensed data.

A single in the system consist of four sensors for measuring the physical parameter of soil (temperature, pH, conductivity etc). The sensed information from these sensors passing through an amplifier is fed to microcontroller unit (PIC controller).

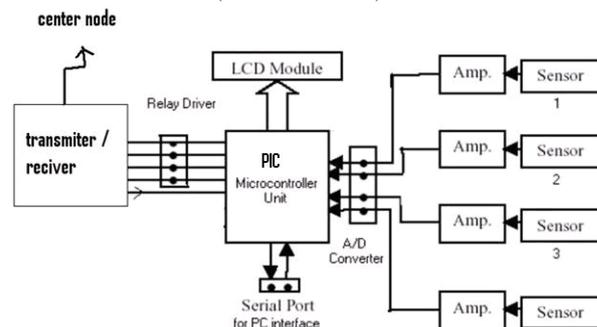


Fig.2. Block diagram of node

#### IV. SYSTEM ARCHITECTURE

The overall system comprised of several subunits. There are large number of motes are placed in the field. The field is divided into a several zones and one mote is place in each zone. The mote consist of sensors, microcontroller, LCD, RF transmitter, RF receiver and power supply unit. First of all the sensors senses the soil data and then they sends the analog signal to the microcontroller. Then inbuilt analog into digital convertor unit in the microcontroller converts the signal into digital form. Then microcontroller sends this data to LCD unit that display that data and to RF transmitter that transmit the data o central control station unit. At control station receiver unit receive the data and display that data. Based on the various parameter values a person which is at control station can be taken.

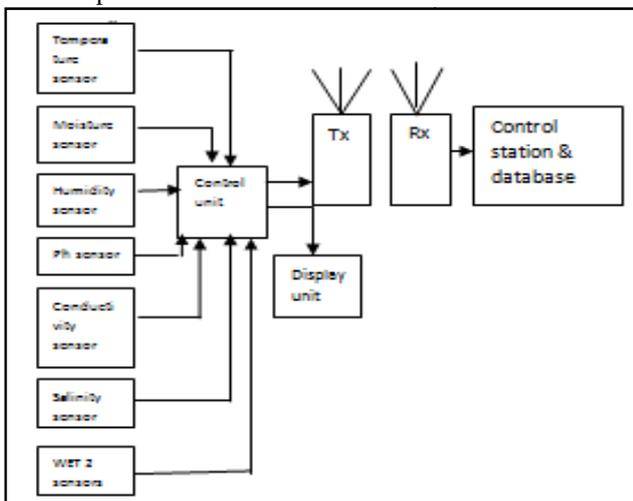


Fig.3. Block diagram of system

#### V. PHYSICAL PARAMETERS

##### A. Temperature

Temperature is also important parameter in the field of agriculture. Plants have maximum growth when exposed to a day temperature. This allows the plant to photosynthesize (build up) and respire (break down) during an optimum daytime temperature. Low temperatures can result in poor growth. Photosynthesis is slowed down at low temperatures. Since photosynthesis is slowed, growth is slowed, and this results in lower yields. Not all plants grow best in the same temperature range. Different types of crops and plants need different temperature, for example wheat needed 20 to 25 °C for maximum yield. Ideal temperature for rice is 5 to 15°C and for corn it is 10 to 30 °C and it is between 10 to 20 °C for soyabean.

##### B. pH

Soil pH is a measure of the acidity in soils. pH is defined as the negative logarithm (base 10) of the molar concentration of dissolved hydroniums\_ions(H<sub>3</sub>O<sup>+</sup>). It ranges from 0 to 14, with 0 being most acidic, 14 being highly basic, and 7 being neutral. Soil pH affects plants nutrient availability by controlling the chemical form of

the nutrient. The preferred soil pH varies between plants and can be modified via various soil amendments.

##### C. Electrical Conductivity

Electrical conductivity (EC) estimates the amount of total salt, or the total amount of ions in the soil. In the soil, the Electrical Conductivity (EC) reading shows the level of ability the soil water has to carry an electrical current. Soil EC is also related to specific soil properties that affect crop yield, such as topsoil depth, pH, salt concentrations and water-holding capacity thus electrical conductivity plays a important role in farm field.

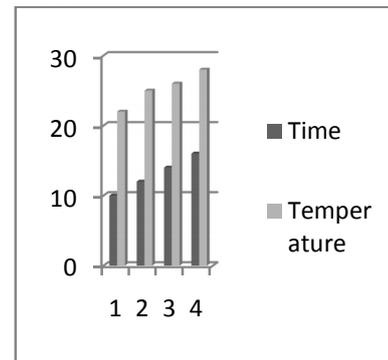
##### D. Humidity

Humidity is important parameter in the field of agriculture. Relative humidity is the ratio of actual water vapor content to the saturated water vapor content at given temperature. It is expressed in percentage (%). Relative humidity directly influences the water relations of plant and indirectly affects leaf growth, photosyntheseis, pollination, occurrence of disease and economic yield. For example when water in the soil was not limiting then seed set in wheat was high at 60% RH comaped to 80%.

#### VI. TEST AND RESULT

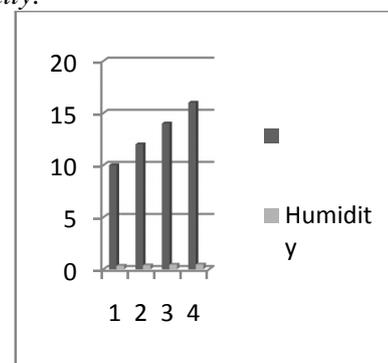
Test were done to verify the reliability and accuracy of all the parameters.

##### A. Temperature



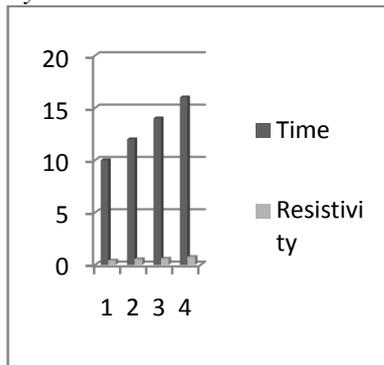
TIME(hours)	10	12	14	16
TEMP(degree)	22	25	26	28

##### B. Humidity:



TIME(hours)	10	12	14	16
HUMIDITY (%)	35%	39%	45%	47%

### C. Resistivity



TIME(hours)	10	12	14	16
Resistivity%	42%	55%	60%	76%

## VII. CONCLUSION

The microcontroller based WSN is very efficient and effective tool for agriculture field. It is very helpful to measure the soil parameter in agriculture and give appropriate results. The values of parameters are easily determined by the help of this module. This module can save the manpower and reduces the farmer's workload.

## VIII. FUTURE SCOPE

This system shall be improved further. At present it can sense and transmit only few parameters like pH, temperature, moisture, resistivity etc. but in future this can be improved by sensing more parameters of soil. Data transmission range can be improved by using GPRS & GSM system.

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