WSN Based Ubiquitous Agricultural Information & Irrigation System (UAIIS)

Chintan Patel¹, Rahul Pal², Suyog Malviya³, Namit Gupta⁴, Preet Jain⁵ and Sumant Katiyal⁶

¹,²,³,⁴,⁵S.V.I.T.S, Indore, ⁶SOE, DAVV, Indore

¹Chintanpatel19826389431@gmail.com, ²rahul_pal42@yahoo.com, ³suyogmalviya@gmail.com, ⁴namitg@hotmail.com, ⁵preetjain@gmail.com and ⁶sumant578@yahoo.com

ABSTRACT

In India economy is mainly based on agriculture. In present era, farmers have been using manual techniques in farming. In the field of agriculture proper information of climatically & environmental conditions are very important. Agriculture and farming is one of the industries which have recently diverted their attention to WSN, seeking this cost effective technology to improve its production and enhance agriculture yield standard. Wireless technologies have been under rapid advance in the recent years. A WSN is a system comprised of RF transmitters, RF receivers, microcontrollers, sensors and power supply. The wireless sensor network can be use to make a agricultural information & irrigation system. This system can significantly reduces the labor cost. This paper presents a wireless sensor network for use in agricultural fields. The overall system comprises of two sections- (1) The first sections comprises of number of motes. (2) Central control system

KEYWORDS

Wireless sensor network, irrigation, automated farm

1. INTRODUCTION

The wireless sensor network is a network that is wireless which consists of sensors that monitors the environmental conditions. wireless sensor networks are used in many fields.Lately,there has been significant interest as regards agricultural monitoring [1-2].Additionally, several studies have been carried out to monitor environmental changes[3-4] and lots of work has been done on WSN as been said in [5-6].This system gives the idea of fully automated farm. This system is very useful for field irrigation. The system senses the climatic conditions & agricultural parameters at the field and transmits them to the observer at the central control station. In this system we divide the field in several zones & place a mote in each zone. The system at field side consists of number of motes. The motes can also communicate with one another.

The motes consist of –

1. Sensors, for sensing environmental & soil parameters.
2. Microcontroller
3. RF transmitter, for transmitting the real time data
4. RF receiver, for receiving signal from central control station.
5. LCD, for displaying data at the field site.
6. Relays, for controlling the motor on/off for irrigation.
7. Power supply

At central control station site there is a system to receive the signals from motes and it display the real time data at the screen. The system can also transmit the signal to on/off the motor at the field according to the received real time data. The use of wireless sensor network in this system provides various advantages such as reduction in wiring, monitoring of hazardous & remote areas and locations.

2. DESIGN OF TESTBED SYSTEM

The overall system is comprised of several subunit. There are large number of motes are placed in the field. The field is divided into a several zones & one mote is place in each zone. The mote consists of sensors, microcontroller, LCD, RF transmitter, RF receiver, relays and power supply unit that provide power to the unit. First of all the sensors senses the soil data and then they sends the analog signal to the microcontroller. Then inbuilt analog to digital converter 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 to 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 take action. For example if the temperature is increased at the field and soil
moisture decreased then a person can send a signal at the field
to turn on motor for irrigation. For this purpose we use a RF
receive unit at the mote that receive a signal and then
microcontroller operate the relay according to the signal. The
relay switch offs or on the motor unit for irrigation.

Components of the system-
1. Temperature sensor.
2. Humidity sensor.
3. Moisture sensor.
4. pH sensor.
5. Motor relays.
6. RF transceiver, for sending the data.
7. RF transceiver, for receiving the data.
9. LCD for monitoring the current reading of all the
parameters.

Every crop needs a specific temperature & moisture. Soil
temperature & moisture play a important role for every crop for
their growth. Measuring soil moisture is important in
agriculture for irrigation purpose. Measurement of soil
moisture is the measurement of water content in soil. Different
types of crop and plant require different moisture level in the
soil to grow. Therefore soil moisture is also very important
parameter for farmers.

Humidity also at the field is a important parameter that must
be known to a farmer because humidity generate pests and
various types of crop diseases. If humidity increases at specific
level then it increases the chance of various plant diseases.

SENSING OF AGRICULTURAL PARAMETERS
The Agricultural information system is used for monitoring of
environmental conditions and some soil properties. At present
system can monitor five parameters that are most useful for any
type of crops.
1. Soil pH
2. Soil temperature
3. Soil moisture
4. Electrical Conductivity
5. Humidity

Soil pH is a important soil parameter that must be known for
every crop. Measurement of soil pH is the measurement of soil
acidity or soil alkalinity. If the soil has pH value less than 7
then soil is acidic and if pH of soil is greater than 7 means soil
is alkaline. Selection of the different types of crop and plants
on field depends on soil pH. Some crops and plants need
slightly basic soil and some need acidic soil. Normal range of
pH is between 6.5 to 7.5. Beyond this range it can affect the
fertility. The pH can also affect the availability of nutrients in
the soil. Therefore soil pH is a very important parameter that
must be known to a farmer at regular interval of time.

Soil electrical conductivity is a property of soil that represents
the soil salt and carbon contents. It is determined by
standardized measures of soil conductance by the distance and
cross sectional area through which a current travels.

3. ANALYSIS OF AGRICULTURAL PARAMETER
3.1. HUMIDITY
Humidity is important parameter in the field of agriculture.
Relative humidity is the ratio of actual water vapour content to
the saturated water vapour content at a given temperature and
pressure expressed in percentage (%). Relative humidity (RH)
directly influences the water relations of plant and indirectly
affects leaf growth, photosynthesis, pollination, occurrence of
diseases and finally economic yield. Moderately low air
humidity is favourable for seed set in many crops, provided soil moisture supply is adequate. For example, seed set in wheat was high at 60 per cent RH compared to 80 percent when water availability in the soil was not limiting.

Temperature is also important parameter in the field of agriculture. Plants produce 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 wheats 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 soybean.

The following graph shows the monitoring of temperature by our test bed.

3.1.1 EFFECTS OF HUMIDITY ON PESTS

(a) The incidence of insect pests and diseases is high under high humidity conditions.

(b) High RH favours easy germination of fungal spores on plant leaves. For example, the blight diseases of potato and tea spread more rapidly under humid conditions. Several insects such as aphids and jassids thrive better under moist conditions.

The following graph shows the monitoring of Humidity by our test bed.

3.2 TEMPERATURE

Soil can be brought back into balance fairly quickly if they are not too far out of the ideal pH range of 6.5 to 7.0. We can make adjustments by applying soil amendments such as dolomite limestone or gypsum. The best way to make pH adjustments is to incorporate compost and mulch.

Applying wood ashes also will raise soil pH. Wood ashes contain up to 70 percent calcium carbonate, as well as potassium, phosphorus, and many trace elements. Because it is powdery, wood ash is a fast-acting liming material.
Most nutrients that plants need are readily available when the pH of the soil solution ranges from 6.0 to 7.5. If the soil is below a pH of 6.0 (acid) some nutrients such as nitrogen, phosphorus, and potassium are less available and if the soil is above a pH of 7.5 (very alkaline) iron, manganese, and phosphorus are less available.

1. If the pH of soil is very acid (pH 5.0 to 5.8) we can take following crops Potato, lily, strawberry, sweet potato, watermelon.
2. If the pH of soil is moderately acid (pH of 5.5 to 6.8) we can take following crops Carrot, corn, garlic, tomato, soybean, sunflower.
3. If the pH of soil is slightly acid (pH 6.0 to 6.8) we can take following crops Grape, onion, mustard, rice. Soybeans prefer a soil pH of 6.0 to 6.8.
4. If the pH of soil is very alkaline (pH 7.0 to 8.0) we can take following crops Acacia, bottlebrush, cabbage, cauliflower, celery, Chinese.

4. BENEFITS
1. This system gives the concept of fully automated farm.
2. This system reduces the wastage of water because a person can operate a motor from home according to the situation.
3. This system significantly reduces the labor cost.
4. Increased productivity because we obtain information of plant disease in the early stage.
5. Reduce the soil erosion.
6. This system is very useful for monitoring the climatic conditions of remote, dangerous and hazardous area.

5. CONCLUSION
In this paper, we report the results of real-deployment of Agricultural information & irrigation system which is designed and implemented to realize automated agriculture. From an environmental point of view it is very important to limit the amount of chemicals and fertilizer in agriculture. Chemicals and fertilizers are one of the major contributors to the pollution, and in some cases total contamination, of lakes, streams and underground water supplies. Applying the proper amount of fertilizers on each part of the field without overlapping or missing is a major step to increased productivity, reduced input costs and limited impact on the environment. This system is very useful for monitoring of environmental conditions at the field. By knowing the information a farmer can take quick action such as provide irrigation or they can use fertilizer that’s why this system can increase the productivity of crops.

6. FUTURE SCOPE
This system shall be improved further. At present we can sense and transmit only few parameters like pH, conductivity, temperature, moisture, humidity. But in future we can improve the system by sensing more parameters such as nitrogen, phosphorus, sulphur content of the soil. Data transmission range can be improved by using GPRS and GSM system.

REFERENCES