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Application of Wireless Sensor Network for Soil Property Monitoring System in Agriculture

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ABSTRACT: Wireless Sensor Networks have attracted much attention now a days. They are collecting ,storing and sharing sensed data.In proposed system we are going to monitor properties of soil .Wireless Sensor Network enables monitoring and managing of large set of environment data which includes climatic, atmospheric, plants and soil parameters that influence cropland growing enviroment . Generally the basic soil properties are soil water holding capacity, moisture content, Temperature, salinity, soil colour, soil texture, fertility of soil, etc. In an advanced Wireless embedded Network has been developed recently for monitoring of soil property at multiple depths and different soil water contents . Wireless Sensor Network consist of Wireless devices that operate below the ground surface. These devices buried completely under dense soil.This Wireless Sensor Network uses multiple sensor nodes to sense soil property data, data sink and long distance cellular network to transmit field data to remote database.

KEYWORDS: WSN, Remote Database, Sensors, Agriculture, Data Sink, Cellular Network.

I. INTRODUCTION

A wireless sensor network (WSN)(sometimes called a wireless sensor and actor network WSAN) is a autonomous sensors to monitor physical or environmental conditions, like temperature, sound, pressure, etc. and to cooperatively pass their data through the main location network.ZigBee wireless communication technology (IEEE 802.15.4) is preferred over other technologies for the development of wireless sensor network due to its low cost and low power consumption property[1].The wireless underground sensor networks could provide users an easy access of real-time field data[7] The development of wireless sensor networks was motivated by military applications such as battlefield surveillance; today such networks are used in many industrial and consumer applications, such as industrial process monitoring and control, machine health monitoring, and so on.

Applications of WSN:

1.Process Management: it's not working for cables or wireless only sensors in management.

2.Health care monitoring: The medical applications includes basically two types :wearable and implanted. Wearable devices are weared on the body of a human or just at very near to the user. The devices in category of implantable medical devices that are inserted inside human body. In health care onitoring there can too many other applications e.g. body position in hospitals and at homes. Bodyarea networks can collect information about an individual's health, fitness, and energy expenditure.

3.Environmental/Earth sensing: To monitor the different environmental conditions and parameters there ae too many applications of WSN's are available. They helps to reduce the harsh environment conditions and power supply. A soil property monitoring system based on The system included a local WSN with multiple sensor nodes to acquire soil property .data, a data sink, and a long-distance cellular network to transmit field data to a remote database. we adopt the technology of wireless Section sensor network based on Zigbee, GPRS and Web Services. The system consists of wireless sensor network nodes and network management platform .Zigbee node respectively transmits acquisition of the temperature and humidity data to the Zigbee stations of gateways node[10].Wireless term describes the telecommunication, in that electromagnetic waves are there to (rather than some form of wire) carry the signal over part or all of the communication path.Sensors provide the ability to monitor conditions from the farm-level down to individual plants. Such sensors include ambient temperature,humidity, soil water content, irrigation pressure, applied

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water volume, and fertilizer concentration.[2]

CHARACTERISTICS:-

1.Power consumption constraints or energy harvesting
2.Ability to cope with node failures
3.Mobility of nodes
4.Heterogeneity of nodes

5.Scalability to large scale of deployment
6.Ability to withstand harsh environmental conditions
7.Ease of use
8.Cross-layer design

II. LITERATURE SURVEY

1.A review of wireless sensors and networks' applications in agriculture Aqeel-ur-Rehman a,b,ˆa, Abu Zafar Abbasi b, Noman Islam b, Zubair Ahmed Shaikh b (2014):- Due to advancement in technologies and reduction in size, sensors are becoming involved in almost every field of life. Agriculture is one of such domains where agricultural domain problems has been an arduous task for novice users due to unavailability of conglomerated information in literature. The aim of this paper is to review the need of wireless sensors in Agriculture,WSN technology and their applications in different aspects of agriculture and to report existing system sensors and their networks are successfully used to get numerous benefits. Selection of sensors and their effective utilization to solve frameworks in agriculture domain.

2.Wireless sensor network with irrigation valve control Robert W. Coates a, Michael J. Delwiche a,ˆa, Alan Broad b, Mark Holler b(2013) : - To promote commercially-available wireless sensing and control networks, valve control hardware and software were developed to be compatible with a commercial wireless sensor node. The work was conducted in collaboration with a wireless network vendor such that the research results and the product itself could ultimately be available to growers. The valve actuation system included development of custom node firmware, actuator hardware and firmware, an internet gateway (base computer) with control, and communication & web interfaces

3.A survey on wireless sensor network infrastructure for agriculture Xiaoqing Yu , Pute Wu Wenting Han, Zengli Zang. (2013) :- The hybrid wireless sensor network is a promising application of wireless sensor networking techniques. The main difference between a hybrid WSN and a terrestrial wireless sensor network is the wireless underground sensor network, which communicates in the soil. In this paper, a hybrid wireless sensor network architecture is introduced. The framework to deploy and operate a hybrid WSN is developed. The experiment was conducted for several soil moistures (5, 10, 15,20 and 25three signal frequencies (433, 868 and 915 Mhz).The results show that the radio signal path loss is smallest for low frequency signals and low moisture soils. The best node deployment depth for effective transmission in a wireless underground sensor network was determined.

4.Wireless Sensor Network deployment for monitoring soil moisture dynamics at the field scale B. Majonea*,F. Vianib, E. Filippic, A. Bellina, A. Massab, G.Tollerd, F. Robolb and M. Saluccib(2013) :-Soil moisture is recognized as one of the main drivers for plant ecosystem and an important state variable for hydrological modeling. Soil moisture is strongly variable in space according to the spatial variability of soil properties and landscape characteristics, which manifest differently when upscaled to the catchment scale. This leads to large uncertainty in describing processes controlled by soil moisture dynamics, such as transport of solutes at the hillslope and catchment scale and plant ecosystem dynamics. Monitoring soil moisture at the hillslope scale, from tens to hundred meters, is therefore essential in many hydrologic and agricultural application.

5.Using wireless sensor network for monitoring growing environment of Tea in North- East India Baruah Rupanjali D., Bhagat R.M.*, Saikia M.,Saikia A., Pathak L.B., Gupta N.1, Sengupta Lahari and Bhattacharyya N.2(2013) :- For drought monitoring in tea plantations, a Wireless Sensor Network (WSN) was used which can collect the temperature, humidity and soil water content, and transmit data remotely to the base station, which provided the characteristics of working stability and reliability in the system.

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6..Soil prooerty monitoring using6LoWPAN-enable wireless sensor network A. Paventhan, Sai Krishna Allu, Sameer Barve, V. Gayathri and N. Mohan Ram ERNET India R&D Centre, Sadashiva Nagar, Bangalo (2012): -The IEEE 802.15.4 (IEEE Std 802.15.4, 2006) Low-rate Wireless Personal Area Networks standard is aimed at applications requiring limited power and moderate throughput requirements. The Internet Protocol (IP) is predominantly used over Ethernet links that offer increasingly high throughput. The transmission of IPv6 packet over LoWPAN links are faced with several challenges due to the resource constraints. However the benefits in enabling IPv6 over 802.15.4 links include: (1) large IPv6 address space and stateless auto configuration (2) easy to monitor/manage the network (3) reusability of application layer protocols (4) seamless and end-to-end integration with internet (5) programmability using of socket APIs. Considering these advantages,the IETF 6LoWPAN working group has defined RFC 4944 specification(6LoWPAN, 2012) to efficiently transport IPv6 datagrams over IEEE 802.15.4 links.

7.An Advanced Wireless Sensor Networks for Soil Property Monitoring Zenglin Zhang , Pute Wu,Wenting Han(2012) :- Based on the test model,research tests and results are discussed. The test of experiment was evaluated based on the path loss and bit error rate under different volumetric watercontent of the soil. The wireless underground sensor networks could provide users an easy access of real-time field data.

8.Wireless Sensor Network solution for precision Agrecuture based on Zigbee Technology,Manijeh Keshtgari,Amene Deljoo.(2012) :- This paper describe sensor nodes and a base station that communicate with each other and gather local inormation to make global decision about the physical environment.

9.Automated Soil Moisture Monitoring Wireless Sensor Network for Long-Term Cal/Val Applications Aurelio Cano1,2,José Luís Añón1, Candid Reig1*, Cristina Millán-Scheiding3,Ernesto López-Baeza2(2012) :- The network consists of a number of automatic measurement stations, strategically placed following soil homogeneity and land use criteria. Every station includes acquisition, conditioning and communication systems.The electronics are battery operated with the help of solar cells,in order to have a total autonomous system. The collected data is then transmitted through long radio links, with ling ranges above 8 km. A standard PC linked to internet is finally used in order to control the whole network, to store the data, and to allow the remote access to the real-time data.

10. Applications of wireless sensor network in the agriculture environment monitoring Yingli Zhua*, Jingjiang Songa ,Fuzhou Dong(2012) :- Wireless sensor network is composed of a large number of micro-sensor nodes which have small volume and low cost. It possesses self-organizing capability by wireless communication. Data acquisition is the central task of the network to obtain information. Compared to the traditional means of environmental monitoring We adopt wireless sensor networks to monitor agricultural environment, it has three significant advantages: (1) It is unnecessary to lay wire, the network is only deployed once, the man-made impact on the control environment is small;

(2) the nodes are dense, data acquisition has high accuracy; (3) sensor nodes with a certain calculation, storage capacity, enabling collaboration among nodes is ideal for unattended remote monitoring. Therefore monitoring parameters of agricultural environment is feasible through wireless sensor network.

III. **PROPOSED WORK**

A. *Work:*

In this project we are going to use MULTIHOPPING using wireless sensor network.We are using the Zigbee module.In this project we using six sensors. For data transmission mesh routing will be used.In mesh routing, the source and the final destination need not be directly connected. The mesh header carries the source and final destination link layer addresses and hop count. The intermediate nodes forwards the packet to the next hop after deducting the hopcount.

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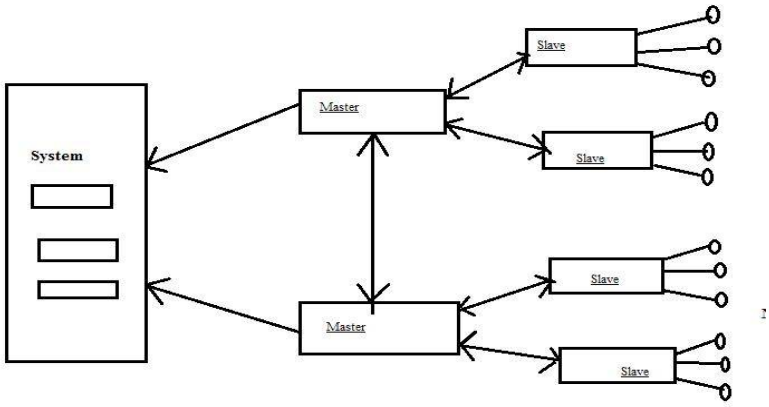
B. *Block Diagram:*



C. *Proposed Mathematical Model:*

Consider the set S={F1,F2,F3,F4,F5,F6,F7}
Where S is the main set having functions F1,F2,F3,F4,F5,F6,F7.
Where,
1.F1 = {username, password}
for user login
2.F2 = {success,fail}
Successfull login → Acess database
Login fail → Retry
3.F3 = Set threshold value manually
4.F4 = Data sensed by sensor
5.F5 = Read sensor values
6.F6 = Comparision of threshold value and sensor values
7.F7 = Output and appropriate action
8.F8 = Logout

D.*Proposed Algorithm: PIECEWISE INTERPOLATION ALGORITHM EQUATIONS:*

Piecewise Linear Interpolation-To generate the lines, the Matlab graphics routines use piecewise linear in- terpolation. The algorithm sets the stage for more sophisticated algorithms. Three quantities are involved. The interval index k must be determined so that

The local variable, s, is given by

$s = x - x(k)$.

The first divided difference is

$\delta(k) = (y(k+1) - y(k)) / (x(k+1) - x(k))$

With these quantities in hand, the interpolant is

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$L(x)= y(k) + (x - x(k))(y(k+1)-y(k))/(x(k+1)-x(k))$

$= y(k)+ s.\delta(k)$.

This is clearly a linear function that passes through (x(k), y(k)) and (x(k+1), y(k+1).

IV. PSEUDO CODE

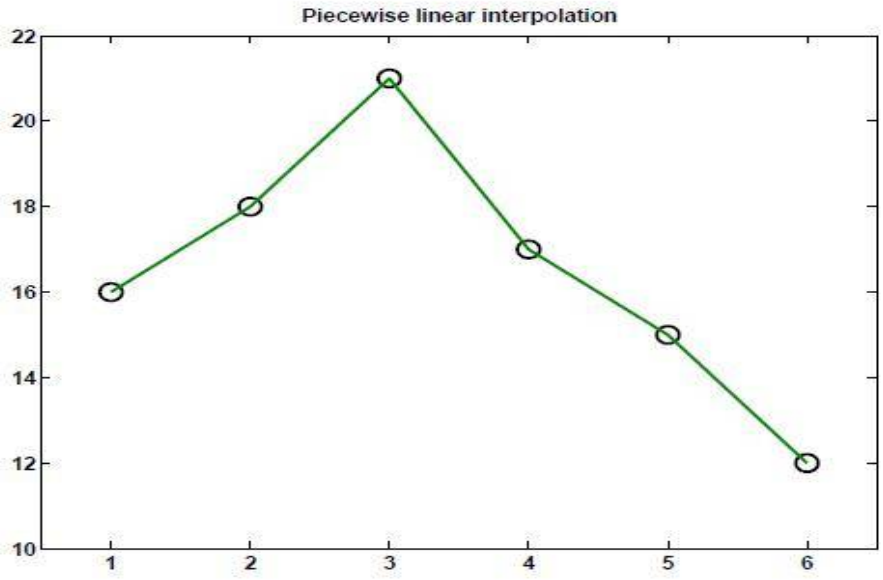
- Step1:Accept the value of x.
- Step2:Accept the value of y.
- step3:find local variable.

  S=x-x(k) ,Where k=0,1,2...
- step4:find first divided differance Delta(k) δ (k) =(y (k+1) − y(k)) / (x (k+1) − x(k))
- step5:then find the interpolant L(x), $L(x)= y(k) + (x - x(k))(y(k+1)-y(k))/(x(k+1)-x(k))$

  $= y(k)+ s.\delta(k)$.

V. RESULTS

This project gives the basic properties of soil based on this the automation systems work according action.The values are displayed using graph points.



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VI. CONCLUSION AND FUTURE WORK

This paper based on Wireless sensor network focused on a design of a soil properties monitoring system in agriculture. The wireless sensor network applied for environment monitoring plays important role which leads to protection of the environment in future and to save water and also for utilization of fertilizers. The basic properties of soil sensed by sensors and processed at Zigbee module .

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