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Use of ICT in Agriculture

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Abstract- Indian is a land of villages, almost 70% people lives in villages in India. Agriculture is the backbone of Indian economy and to strengthen it we have to use modern agricultural techniques. This paper proposes the use of Wireless sensors network and cloud computing to increase the production with least waste of resources and time. WSN monitors the soil moisture, pH, temperature and other important factors. It helps the farmers to understand the individual crop and its requirement. WSN make farmers to identify and use fertilizers, irrigation and other requirement at appropriate amount and time. WSN are itself capable of performing tasks like automatic irrigation and automatic sprinkling of fertilizers after analyzing the data gathered by it. Cloud computing application make farmer more smart and intelligent. WSN can be interface with a Cloud which stores data generated by sensor nodes. Cloud allows famer to check his a farm data anywhere in the world at any instance of time and the same data can be accessed by experts at different locations to advise appropriate measures to overcome the issues.

Keywords- Cloud Computing, pH value, Soil temperature, Soil moisture, Humidity, ATmega328

I. INTRODUCTION

We are discussing the concept of smart agriculture in this paper. In Smart Agriculture different sensors from the field collects soil moisture, soil Ph , soil temperature and etc then sensors with the help of microcontroller transmit all collected data to base station wirelessly[1] .The base station is programmed and is interface with a cloud. The base station transfer the data to a cloud .Now the farmer can access the cloud and check the farm information. Farmer is able to make decisions more accurately as cloud always provide experts' advice [2][3]. Our wireless sensor network is also configuring in the way where it can perform automatic irrigation also.

1.1WSN Technology

The involvement of human in solving day to day life problems can be greatly reduced by using WSN. The WSN allows every device to connect wirelessly to each other, devices and communicate with each other. WSN is formed with the help of nodes or sensors connected to each other with in a network wirelessly. Sensors in WSN can be used to monitors the physical phenomenon or the environmental changes, like temperature, pressure, humidity, sound, light, etc. this physical phenomenon is converted into electrical signals and transmitted to remote locations or to internet. The transmission of data can be bidirectional means we can control the working of sensors from far end as well[4][5]. The WSN consist of collection of "nodes" connected through wireless link, each node is connected of one or more than one node. Each sensor node in a network node have several parts: A Microcontroller, battery, radio transceiver with antenna, an electronic circuit for interfacing with the sensors ,can have device for energy harvesting. The sensor nodes can be connected in single hop or multi-hop topology. The data propagation can be performed either in flooding or in controlled manner depends on the requirement[6].

1.2 Cloud Computing

The cloud computing is a popular term used for "The Internet" based computing. In this you may store or even process the data on internet. Cloud computing is used to save the resources and the cost of processing in this you can share computing resources rather than having the local servers or personal devices to handle applications. Cloud computing provides services like servers, storage and applications required by an organisation through the internet. The main advantage of using cloud computing are On-demand self-service, high speed network access, Rapid elasticity, Resource pooling. The service models of cloud can be use Software as a service(Saas), Platform as a service(Paas), Infrastructure as a service(Iaas).There are many advantages of cloud computing means you need not to think about underlying details of infrastructure, applications interface with the infrastructure via the APIs.

Second The cloud have "elasticity and flexibility" which allows these systems to scale up and down at your will. The resource utilization like CPU, storage, server capacity, load balancing, and databases are up to the maximum. Last but not the least you have to pay only for the services you are using. In this the system remain always on irrespective of location and time.

II. SOILPARAMETERS TO BE MEASURED

There are many parameters of the soil which are to be measured out of all four parameters are important. Our system is used to monitoring various environmental conditions and some soil properties. The present system will monitor four important parameters that are useful for any type of crop are given below..

1. Soil pH
2. Soil temperature
3. Soil moisture
4. Humidity

Selection of crop depends upon the type of soil and the environmental conditions of the region, one of the important parameter is soil pH. Soil pH is the indication of nature of soil means it shows that soil is acidity or alkalinity. If the soil have pH is greater than 7 the soil is alkaline and if the pH is below 7 then the soil is acidic. Every crop grows in specific temperature and soil temperature. Soil temperature & moisture play an 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 [7].

Humidity also at the field is an important parameter that must be known to a farmer because humidity generates pests and various types of crop diseases. If humidity increases at specific level then it increases the chance of various plant diseases [8].

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 travel.

III. DESIGNING AND IMPLEMENTATION

The overall system is comprised of several sub units. The area under surveillance is divided into a several zones & each sensor node is place in each zone. The sensor node consists of sensor, microcontroller, Xbee series 2, relays and power supply unit that provide power to the sensor node. The sensed analog soil data converted into digital form by analog to digital converter unit inbuilt in microcontroller [9]. Then microcontroller sends this data to Xbee module which transmits the data to central control unit. The control station receiver data from central unit upload that data into cloud. Based on the various parameter values a person or program will take necessary action and actuators will act accordingly. For example if the temperature is increase up to specific level at the field and soil moisture decreased then a system will generate a signal at the field to turn on actuator for irrigation. For this purpose we use an Xbee receiver unit at the node that receive a signal and then microcontroller operate the relay according to the signal. The relay switch off 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. Xbee series2.

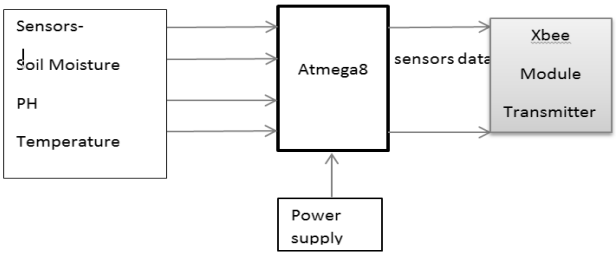

Fig.1: Motes

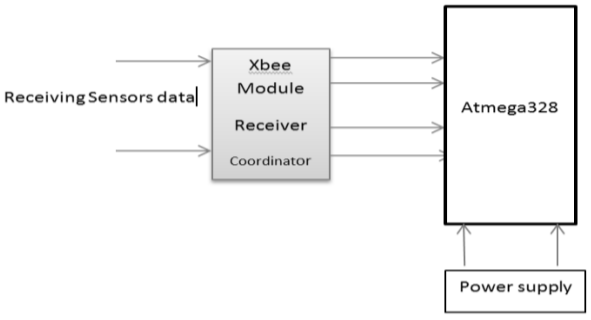

Fig.2: Bases station

IV. HARDWARE SPECIFICATIONS

1. Atmega 8

The Atmega 8 is a low-power 8-bit AVR RISC-based microcontroller having 8KB of programmable flash memory, 512K EEPROM , 6 or 8 channel 10-bit A/D converter and1KB of SRAM. It supports throughput of 16 MIPS at 16 MHz and operates between 2.7-5.5 volts.

2. ATmega328

The ATmega328 is a high-performance Atmel 8-bit AVR RISC-based microcontroller having 32KB ISP flash memory with read-while-write capabilities, 23 general purpose I/O lines , 32 general purpose working registers ,1KB EEPROM, 2KB SRAM, , three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, 6-channel 10-bit A/D converter (8-channels in TQFP and QFN/MLF packages), programmable watchdog timer with internal oscillator, and five software selectable power saving `modes. The device operates between 1.8-5.5 volts. By executing powerful instructions in a single clock cycle, the device achieves throughputs approaching 1 MIPS per MHz, balancing power consumption and processing speed[10].

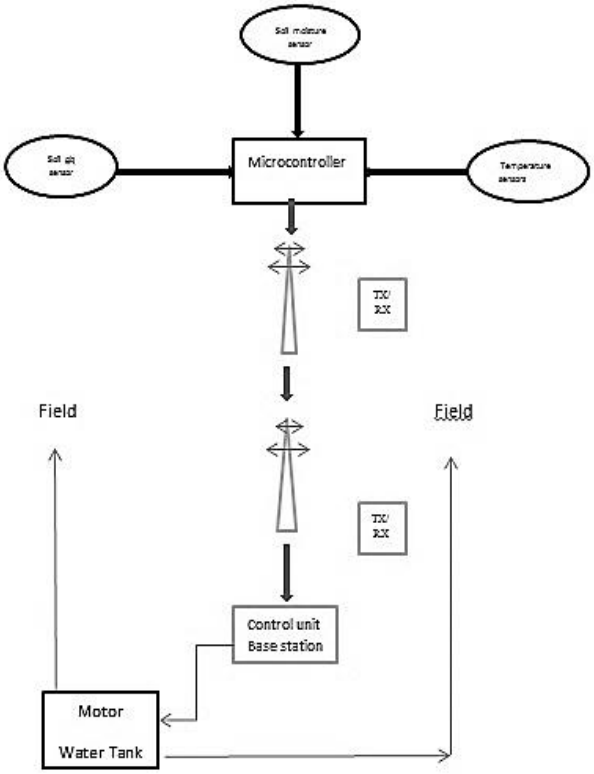

Fig.3

XBee Series 2(XB24-Z7WIT-004) module from Digi Series 2 improves the power output and data protocol. Series 2 modules allow you to create complex mesh networks based on the XBee mesh firmware. These XBee modules are having very simple and reliable communication between different microcontrollers, computers, relays and anything having serial port. It can operate in both Point to point and multi-point networks.

V. Future Work

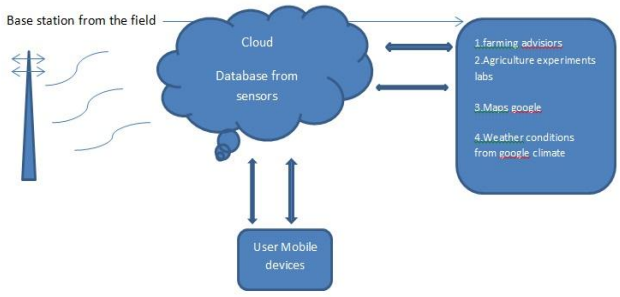

Fig.4: Cloud with base station

In future work we are interfacing the cloud to our wireless sensor network cloud computing implementation make the data base of data collected daily by the sensor from the field. Cloud records the details for user use cloud is connected to form advisors, agriculture experiment lab, Google climate and etc. farm advisors upload necessary steps for farming on the cloud by analysing the data user can access the cloud anytime for field management and check field conditions.

VI. CONCLUSION

In this paper, I have proposed the benefits of cloud computing with WSN. The technology make farmer more smart and intelligent because farmer is able to take decision on the basis of database and actual farm conditions.

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