Brisk Environmental Monitoring Using Iot For Agriculture

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Abstract-*In India majority of the people depend on farming for livelihood. Hence it is very important to perform some methods in order to protect farming sector from disasters like chemicals, high water level etc. Due to the use of different kinds of sensors in the agricultural fields the work of farmers in the cultivation has become simple and easy. Therefore, improves the quality of food grains and decrease in the use of the insecticides and fertilizers thereby increases the overall profits of the farmers. For some recovered problems, a system is proposed that gives ideas regarding the sensors that could effectively reveal the information regarding nitrate concentration, temperature, humidity and soil moisture sensor. This study can be extended then by including a temperature compensation capacity within the nitrate sensor. Wi-Fi-based Internet of Things (IoT) has also included that is connected to a sensing system. Here, the system is able to send data directly to an IoT-based web server, which may be useful to develop distributed monitoring systems in the future.*

Keywords-IoT, Wi-Fi, Web Server, Sensors, GSM

I. INTRODUCTION

The development of economic condition of a country depends on the agricultural sector, but as India is a developing country unfortunately most of the farmers still use the traditional methods of farming which results in low yielding of crops and fruits. But wherever technology is implemented human beings are replaced by automatic machineries, hence the yield has been improved. In an agricultural country like New Zealand, the concentration of nitrate in surface and groundwater is concerning and has been recovered as a vital issue facing New Zealand's future[1].

Some of the sources of nitrate are considered as dairy farming, disposal of human and animal sewage, urban run off and industrial waste to land or into water resources. Nitrate-nitrogen (NO3–N) is a major component of the supply of protein hence it is the fundamental element for the growth of plants and animals so it is widely used in the agricultural sector to increase plant production. But there is another side that if nitrate concentration increases to a certain level from threshold value then it may cause some disorders , and this issue is mostly effected in agricultural areas[1].

In New Zealand, the largest source of nitrate contamination can be considered due to cattle urination from dairy farming contamination as the highly concentrated nitrate deposits leach into groundwater, which to extend increases the nitrate concentration of surface water . Due to high nitrate-N concentrations the pH of the water and lower oxygen concentrations also changes that affects aquatic life and degrades fish habitats. Blue baby syndrome is major disease caused due to the elevated nitrate concentrations in drinking water. According to Environment Protection Agency (EPA), the drinking water may contain nitrate-N to a level of 10 mg/L[1].

Due to the rapid development in telecommunication technologies, it is believed that wireless communication along with Global System for Mobile communication (GSM) and Short Message Service (SMS) has played an important role for remote sensing in the agricultural fields. The day-by-day achievements in advanced technologies also created a wide area for helping the farmers by reducing human effort also identifying the requirements of farmers mainly using three sensors, to be exact, Humidity, Temperature and soil moisture sensors[3].

The presented paper proposes a system which is useful in monitoring the field data also controlling the field operations that provides flexibility. The main aim of this paper is to make agriculture smart using automation and IoT technologies. Farmers can gather enormous information and knowledge about the recent trends and technologies using IoT. Also an architecture is put forward for the networking of these sensors, through which the data is transmitted from the sensors using zigbee module to the microcontroller and then processed information is received by the farmers through SMS[3].

II. RELATED WORKS

For checking the parameters in agriculture manual method is the oldest method and it can be considered as the existing system. This method includes that farmers by themselves verify all the parameters and evaluate the measurements. It mainly give importance on development of devices and management of tools, also display and alert the users about the advantages of using a Wireless sensor network system. Using automation and IoT technologies it mainly aims at making smart agriculture[14].

The regional officer's monitors water samples from rivers, lakes and groundwater in a daily manner where the samples of water are collected by staff at a regular interval of time, usually on a weekly, monthly or yearly basis. It is important to know that nitrate-N concentrations may change with increase and decrease in a stream or river flows. Hence a monthly sampling method may not sufficiently or accurately represent the actual nitrate-N profile. Further this might influence the knowledge of the seasonal effects on nitrate-N loss. Also this information may be vital for regional officers to implement with a policy and management accurately and precisely. So there is a necessity for low-cost, low concentration, real-time, smart nitrate sensors and sensing systems, to measure nitrate concentrations in water along with soil moisture and humidity[1].

However, the human efforts can be reduced to a greater extend by the invent of technologies in the agriculture sector. Use of technology in agriculture field plays an important role in the increase in the production as well as in reducing the extra manual efforts. Some of the research attempts are made for better technologies that may help farmers for the better yield [5].The whole system was developed using three in field sensor stations that collects the data and send it to the base station using global positioning system (GPS)[17].

In the studies related to wireless sensor network, researchers measured soil related parameters such as temperature and humidity for which sensors were placed below the soil which communicates with relay nodes that increases the life time of soil monitoring system. This system was developed using microcontroller, universal asynchronous receiver transmitter (UART) interface and sensors where the transmission was carried out by hourly sampling and buffering the data, transmit it and then checks the status messages[17].

In order to take the decision whether the irrigation must be enabled or not, a low cost and efficient wireless sensor network technique is proposed to acquire the soil moisture and temperature from various location of farm and as per the need of crop controller. Cost and deployment of sensor under the soil which causes attenuation of radio frequency (RF) signals are considered as the drawbacks of this system[14].

The use of wireless sensor network , collects the data from various types of sensors and then transmitted it to a main server using wireless protocol is being signified by most of the papers. These collected data gives information about numerous environmental factors which may in turn helps to monitor the system. Monitoring environmental factors is not sufficient and the complete solution to improve the yield of the crops rather there are many other factors that may affect the productivity. Attack of insects and pests are the factors included that can be controlled by spraying the crop with proper insecticide and pesticides For monitoring the field data as well as controlling the field operations that provides the flexibility is being proposed in this paper[12].

III. PROPOSED SYSTEM

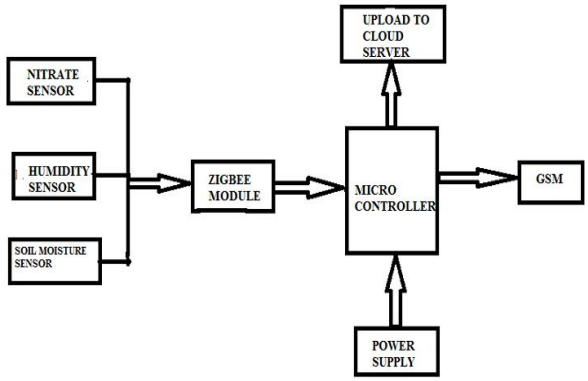

Fig 1: overall architecture of the system

The proposed system consist of three sensors that is nitrate sensor, humidity sensor and soil moisture sensor. The information's from these sensors is in analog form which is converted to digital form using an analog to digital convertor and then given to the microcontroller through a zigbee module. Microcontroller analyze and process the data , the processed the data is further uploaded to the cloud server and also provided to the mobile phones of farmer through SMS using GSM module.

1. Nitrate sensor :

For the detection of nitrate-N in water samples for this research Planar type interdigital sensors have been used . The principle of detection of nitrate ions is based on the change of electric field generated between two types of electrodes , hence Planar interdigital sensors behaves like a

parallel plate capacitors. The sensor used here is to measure the temperature and also the same sensor was used to measure the nitrate concentration. For measurement the sensing part of the sensor was immersed in the sample water. According to their charge the nitrate ions are polarized towards the plates. Thus the nitrate concentration can be easily computed. Here a temperature sensor is used along with the nitrate sensor because ions concentration may differ as temperature differs[1].

2. Humidity sensor :

The HH10D relative humidity sensor module is comprised with a capacitive type humidity sensor, a CMOS capacitor to frequency converter and an EEPROM used to holding the calibration factors. The system can respond to humidity change very fast, due to the characteristics of capacitor type humidity sensor. Each sensor is calibrated twice at two different accurate humidity chambers, two unique sensor related coefficients are stored onto the EEPROM on the module. The data is used for humidity calculation.Humidity measurement devices mainly depend on measurements of quantities like temperature, pressure, mass or a mechanical or electrical change in a material when moisture is taken in. By calibration and calculation of these measured quantities will lead to a measurement of humidity.

The humidity sensor is a capacitive type that is it consist of at least two electrodes and also in between a humidity sensitive dielectric is located. One of the two electrodes is provided on an electrically highly insulating support which consists of glass or ceramic and is referred to as a substrate. The second electrode, designed as a metallic layer, is permeable to moisture, i.e. diffusion of water molecules through it is very easy. Humidity increases when water molecules penetrate the dielectric layer, the capacitance of a capacitor that can be used to measure also increases[5].

3. Soil moisture sensor :

Soil moisture sensors measure the water content in soil. A soil moisture probe is consists of numerous soil moisture sensors. One common type of soil moisture sensors in commercial use is a Frequency domain sensor such as a capacitance sensor. The neutron moisture gauge is the another sensor which utilizes the moderator properties of water for neutrons. Soil moisture content may be determined via its effect on dielectric constant by measuring the capacitance between two electrodes implanted in the soil. Here the soil moisture is essentially in the form of free water (e.g., in sandy soils), the dielectric constant is equivalent to the moisture content. The probe is normally given a frequency excitation to permit measurement of the dielectric constant. The readout from the probe is non linear with water content and is effected by soil type and soil temperature. Therefore, careful calibration is required and long-term stability of the calibration is questionable [9].

- In this sensor we are using 2 Probes to be dipped into the Soil
- As per Moisture we will get analog Output variations from 0.60volts - 5volts
- Input Voltage 5V DC

IV. CONCLUSION

A portable, novel sensing system has been created that might be used on-site as a stand-alone device, as well as IoT-based remote monitoring smart sensor node, to measure nitrate concentration in surface and ground water. For monitoring agricultural parameters Zigbee-based agriculture monitoring system serves as a reliable and efficient system. The corrective action can be taken. Wireless monitoring of field gives user to lower the manual power and also provide user to observe accurate changes in it. The measured nitrate data can be uploaded by the system on a website based on IoT. This system could be used to integrate water quality monitoring sites within farms, or between streams, rivers, and lakes. At the monitoring site for the in-situ installation, a robust box containing the whole system would need to be installed. For large acres of land this system can be enhanced in future development. To check the quality of the soil and the growth of crop in each soil the entire system can be integrated. Successful interface of sensors and microcontrollers and wireless communications are achieved between various nodes. Overall production and yield of crops can be improved by implementing such a system in a field. Consumption of power is less and is cheaper in cost.

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