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Precision Agriculture using Internet of Things and Wireless sensor Networks

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ABSTRACT:

The Internet of Things (IoT), the idea of getting real-world objects connected with each other, will change the way users organize, obtain and consume information radically. Internet of Things (IoT) enables various applications (crop growth monitoring and selection, irrigation decision support, etc.) in Digital Agriculture domain. The Wireless Sensors Network (WSN) is widely used to build decision support systems. These systems overcome many problems in the real-world. One of the most interesting fields having an increasing need of decision support systems is Precision Agriculture (PA). Through sensor networks, agriculture can be connected to the IoT, which allows us to create connections among agronomists, farmers and cropsregardless of their geographical differences. With the help of this approach which provides real-time information about the lands and crops that will help farmers make right decisions. The major advantage is implementation of WSN in Precision Agriculture (PA) will optimize the usage of water fertilizers while maximizing the yield of the crops and also will help in analyzing the weather conditions of the field.

Keywords *: IoT, precision, WSN,*

INTRODUCTION:

Agriculture is the science, art or practice for cultivating the soil, producing crops usingdifferent preparation methods and technologies and marketing the resultant products produced in the farming. India is an agriculture based country. Most of the Indian families follow agriculture as their main occupation. Farmers can be termed as the ecosystem engineers as they cultivate the crops in the ecosystem using different engineered methods, techniques & machines. The traditional farming practices along with the following conditions such as dependence on monsoon, fragmented land farming and holding, poor infrastructure in rural areas and less usage of technology applications still holds the Indian agriculture behind in the race of modern agriculture. As the Indian agriculture still follows the traditional methods which do not give efficient results in contrast to the effects observed with the help of new technologies. The modern farming practices revolve around the new concepts such Internet of Things (IoT), Wireless Sensor Networks (WSN) and Precision Agriculture (PA). The Internet of Things can be defined as the network of physical objects or devices embedded with

electronics,software's, sensors and network connectivity which enables these objects to collect and exchange data. Whereas the Wireless Sensor Network is the spatially distributed autonomous sensors to monitor physical or environmental conditions and to co-operatively pass their data through the network to a main location. Precision Agriculture can also be termed as satellite farming or site-specific crop management. It is a farming management concept based on observing, measuring and responding to inter and intra-field variability in crops. This concept of Precision Agriculture (PA) using Wireless Sensor Networks is very helpful for the farmers to increase the yield of the crops also keeping in mind the use of modern technologies instead of traditional farming practices

II. ORGANIZATION OF PAPER:

While starting with literature survey we will discuss the proposed system with architecture and its test results. Then conclusion derived from the approaches we used and future scope of enhancement. At the end references used for preparing this paper are shown.

III. LITERATURE SURVEY:

The concept of the Internet of Things first became popular in 1999, through the Auto-ID Center at MIT and related market-analysis publications. Researchers have proposed different models for agriculture sector with one or multiple technologies mentioned above e.g. irrigation system based on soil water measurement to decide irrigation amount of the water is described inWhich uses the Bluetooth model for the communication which has its own limitations

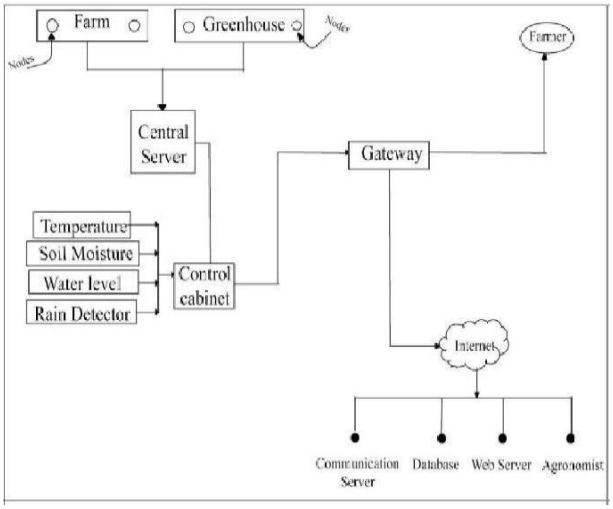
Like limited range and device accommodation. In the year of 2009, an author suggested scheduling in the power supply to the sensors which will help in improve energy efficiency [2]. Use of IoT in agriculture is mentioned by an author inpaper [3]. However it shows lack of interoperability which is necessary when we talk about large agricultural fields. For comparison of energy consumption between two appliances, Jingohan has provided an approach in paper [4] published in 2011. N.K. Suryadevara, S.C. Mukhopadhyay has used concepts of pervasive computing, data aggregation etc to monitor the environmental factors using Zigbee

[5] in their paper. Increase in number of sensors is suggested by the author to improve the accuracy of the data collected. However, it might raise the issue of more power consumption as more nodes has been deployed. Approach to provide the real time information to the farmers about the land and crops is defined in the paper [7], which provides the necessary information yet it's a standalone system. In the year of 2015 concepts of IoT, cloud-computing, Mobile computing are used in smart agriculture in paper [8], where by Prem Prakash Jayaraman, Doug Palmer, ArkadyZaslavsky the concept of phenome was introduced which is network of smart wireless sensor nodes who shares the information with each other as well as central system. Yet both the papers however does not provide any interpretation of the data even though large amount of useful data is generated. Although researchers have proposed few models in agriculture domain using one or more of the technologies mentioned, we aim to develop an integrated system of multiple functionalities with data interpretation and simpler interface.

IV. PROPOSED SYSTEM:

Considering the need of modern technology in farming, we propose a system which is integrated to have a control on all the deployed systems in a single system. The farmers can use the system conveniently as it has a simple user interface. Also the system will keep the farmers well notified about the every minute event that occurs in the field based on farmer can take a better action.

System Architecture



The Central System is the core component of this architecture. It is the Raspberry Pi which is connected to Arduino UNO R3 ATmega328P/ATmega16U2 (Development Board) and the clients to a router through WiFi module. The router is used for the access of web pages through UI by theclients .The Arduino UNO R3 ATmega328P/ATmega16U2 consists of WiFi module and sensors which includes

(i)Temperature and Humidity Sensor(DHT11/DS18B2probe/DS18B20/PT1000-probe)

(ii)Soil Moisture Sensor (DX25259/KGSM/OEMSM)

(iii)Water Level Sensor(DX276572/DX314464/KG-Floating Ball)

(iv)Rain Sensor(DX266534/KG004/GenericRS).

TheDeployment Board is deployed in the fieldby the farmer which gives the informationabout the temperature and humidity, soilmoisture, water level and rain respectively.The Raspberry Pi acts as the OperatingSystem which analyzes the data collectedby the sensors in the deployment model andnotify the farmers about it. Based on thenotification and constant check of the fieldwith the help of deployment board(sensors), the farmers can take appropriatedecisions for the betterment of the field. Theusers or client other than the farmers couldbe agronomists as well which can use thearchived data from the database of a certainregion which can be used for the furtherresearch which in turn can also be helpfulfor the farmers as well.

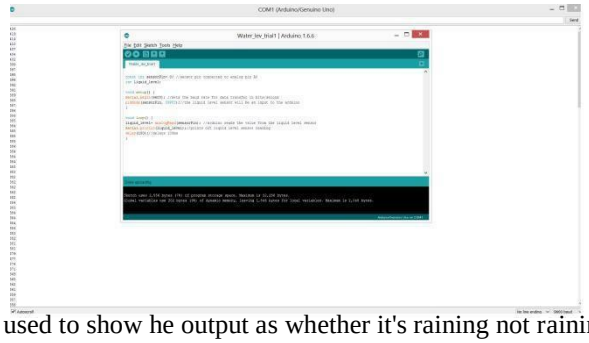
V. TEST CASES AND RESULTS:

As Arduino is based on ATmega microcontroller with 14 digital and 6 analog inputs, for recording the sensor reading we are going to use analog pins. When we connect the sensors to Arduino, by using the proper code

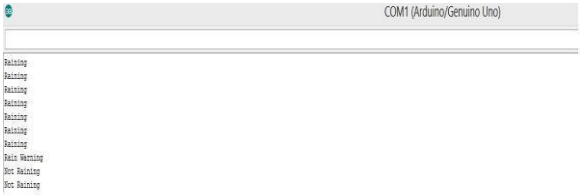
sensors can be designed to show following outputs (These sample outputs are taken on com port of Arduino to verify sensor readings.):

Temperature : It is categorized in High, low and Normal temperature with showing precise value also.

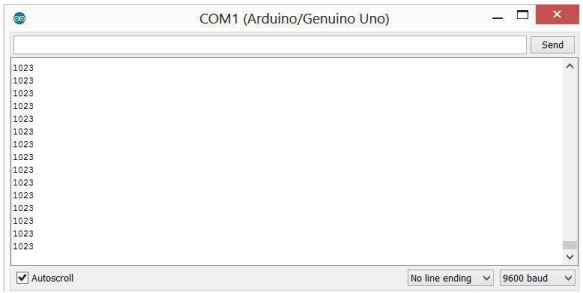
Water Level: The level of water is also categorized in three categories Low, Adequate and Full.



Rain Detector : Rain detector used to show he output as whether it's raining not raining or Highly raining.



Soil Moisture : When tested with a wet soil, soil moisture shows its maximum threshold as output i.e. 1023. Refer the following output-



Now these outputs are transmitted to central server where it combines all the data and expected result is propagated to End user.

VI. CONCLUSION:

As an important constituent part of the IoT, sensor networks enables us to interact with the real world objects. In this project we are dealing with the sensor network design that plays major role in connecting agriculture to the IoT. The connection sets up the links among agronomists, farmers and farm leading to improvement in the production of agricultural yield. It is a comprehensive system designed to achieve precision in agriculture with keeping farmer's ease of access to the data in mind.

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