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# Transforming the agriculture industry using IoT

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*Abstract-* ***Agriculture plays a vital role in the development of agricultural countries like India. The growth of agricultural sector will consecutively impart a great contribution in the development of our country. Agriculture is an industry that has already taken big steps to integrate IoT and its benefits and also a wide range of industrial IoT applications have been developed and deployed. However IoT for agriculture should be considered differently against other areas. One of the most interesting fields having an increasing need of decision support systems is Precision Agriculture (PA). Therefore, this paper aims at Smart Agriculture using IoT technologies. This involves monitoring of the complete farming cycle. The monitoring is done by using sensors or robots which help in connected to the IoT, which allows us to create connections among agronomists, farmers and thereby helping farmers to make right decisions. Therefore, farmers can easily observe whole cycle from seeding to selling using IoT based decision supporting system.***

***Keywords - IoT, ZigBee, SmartAgriculture, sensors, greenhouse monitoring, Precision agriculture.***

## I. INTRODUCTION

The Internet of Things (IoT) is the inter-networking of physical devices, vehicles (also referred to as "connected devices" and "smart devices"), buildings, and items embedded with electronics, software, sensors and network connectivity which enable these objects to collect and exchange data. The IoT allows objects to be sensed or controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic benefit in addition to reduced human intervention. Agriculture is the basic source of livelihood of people in India. In past decade, it is observed that there is not much crop development in agriculture sector. Food prices are continuously increasing because crop rate is declined. It has pushed over 40 million people into poverty since 2010.

### A. *Role of IoT*

Conventional agriculture is slowly changed into digital agriculture namely Precision Agriculture (PA). Smart technology deployed for modern farms grow together with the area of Precision Agriculture. Using the Internet of things, big data, and expert system for precision farming is what agricultural producers around the world are interested in. Precision agriculture emerged in the late 1980's with the matching of grid-based sampling of soil chemical properties with the newly developed variable-rate application equipment for fertilizers.

Precision agricultural services provide the means to fight epidemic diseases by applying the appropriate types and amounts of fungicides, pesticides and organic fertilizers at the right times achieve efficient water consumption by watering the plants with only the needed amount of water and the right time reduce the harm to the environment since knowing when to spray a pesticide does not only lead to effectively killing harmful pests but also reduces the use of the pesticide, and produce high value agriculture productions by growing non-toxic, safe, and healthy crops.

### B. *Common Agriculture Policy (CAP)*

Common Agriculture Policy (CAP) implement new points inside of the new term "Greening". This policy aims to obtain energy efficiency and reduction of fertilizers in crop production IOT in integration with Wireless sensor networks. It has potential to change the way of development in agriculture and gives great contribution to make it smart agriculture [1].

C. *Green House Monitoring System*

Greenhouse is starting to become a common method in crops business.It is designed to satisfy the need of remote monitoring and control of green house.It can improve the efficiency of environment room and reduce the human resource investment.[5]

D. *Using WSN and WMSN*

Arduino, sensors for the different environmental factors and a camera are used that will capture images of the crops at regular intervals. The images captured will be processed to recognize the various morphological changes occurring due to different environmental factors [4].

## II. LITERATURE SURVEY

A. *Common Agriculture Policy*

Common Agriculture Policy can be achieved by applying new technologies in farms with traditional methods. But it is impossible to develop on large scale fields of crop production. Information Technology (IT) are aware of this problem and tries to solve with Service Oriented Architecture(SOA),where each exposes a standard interface for communicating with each other systems [1].

B. *Greenhouse Monitoring System (GHMS)*

Greenhouse Monitoring System (GHMS) is based on Wireless Sensor Network (WSN) technology. In this particular application, GHMS is used to manage the greenhouse condition. GHMS will read the wetness of the soil media in the greenhouse by using moisture sensor. GHMS will read wetness of the air in the greenhouse by using humidity sensor. GHMS read the heat of the air in the greenhouse by using temperature sensor. Based on the sensors reading GHMS will automatically decide to ON or OFF devices such as water pump for irrigation, fan for air circulation and mist for adding water in the air and to increase the humidity. A kind of GHMS which is low cost, low power consumption can be achieved using technology called ZigBee. In this, Sensors are used for collecting information like Temperature, Humidity, Light and $Co_2$.With this; the system will decide action on fans, Sprinklers etc [5].

C. *Usage of WSN and WMSN*

The internet of things involves a three-tier system. It includes perception layer, network layer and application layer. Perception layer includes sensor motes. Information Communication Technology (ICT) enabled devices, sensor motes are building blocks of sensor technology. It includes cameras, RFID tags, sensors and sensor network used to recognize objects and collecting real time information. The network layer is an infrastructure of the IOT to realize universal service. It directs towards the combination of the perception layer and application layer. The application layer is a layer that combines the IOT with the technology of specific industry.

Internet of Things (IoT) is a network of sensors and connectivity to enable application like agriculture optimum irrigation. Wireless sensor network (WSN) and Wireless Moisture Sensor Network (WMSN) are components of IoT. The use of WSNs in precision agriculture increases the efficiency, productivity and profitability of many agricultural productions [4].

## III. METHODOLOGY

In this paper, we are discussing about Greenhouse monitoring system using ZigBee technology. In the proposed irrigation system, agricultural land is divided into parcels. Each parcel has temperature sensor, humidity sensor, and soil moisture sensor in which it senses the data and collects the information and transmits it into the ZigBee. It collects the information periodically for every 10sec.

A. *ZigBee Transmitter*

ZigBee is a wireless communication device. It is used to communicate the data from ZigBee transmitter to ZigBee receiver. By the use of transformer, power supply is divided into each section of the circuit in both of them. In transmitter section of Fig. 1, Temperature sensor, Soil moisture sensor and Humidity sensor are used to senses the data. Temperature sensor implemented in this system is thermistor type of sensor. It senses the temperature level in the field which is measured in the unit of Degree Celsius. Humidity Sensor senses the humidity level in the air. Soil moisture sensor senses the water content in the soil. This sensor is buried into the soil. These sensors sense the different physical data and convert into electrical signal. All the respective electrical signal of the sensors is connected into each of the respective Amplifier. These Amplifiers converts the weak electrical signal into strong electrical signal. These signals are connected into the internal ports of PIC microcontroller. PIC Microcontroller is already programmed using the programming language which is Embedded C. It is implemented using MP Lab Simulator (Microchip Laboratory). PIC has inbuilt of ADC (Analog to Digital Converter). It converts analog value into digital value. This value is stored and it is compared with reference value. Keypad is used to enter the reference value of the sensors. If the soil moisture value is less than reference value and also if water tank level is high, then pump will be started automatically. Otherwise pump will not get started.PIC Microcontroller is connected with Driver circuit which is used for proper

switching of the relay. Relay is an electromechanical switch which is used to activate the pump and water tank. The water pump is attached to relay.

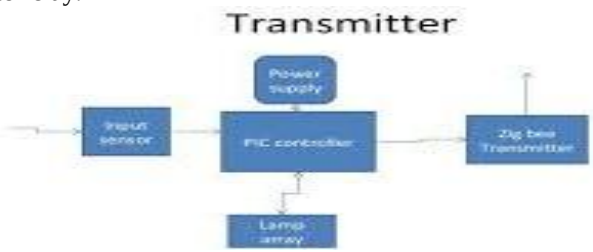


Fig.1 Zigbee Transmitter block diagram

B. *Decision making System*

The first step is to initializing the system. Then the system collects the values from each sensor as parcels. Each sensor values is compared with the reference values for each parcel and if it is less than the reference value, then the irrigation process get started. Otherwise the system starts to collects the next periodical information.

C. *ZigBee Receiver Section*

Data is received from the sensors by the use of ZigBee. It is connected to PC through RS232. RS232 is used to connect the computer serial ports. By the use of the software named Visual Basic. This software is used for analyzing the data of humidity level, soil moisture level and temperature level in PC.

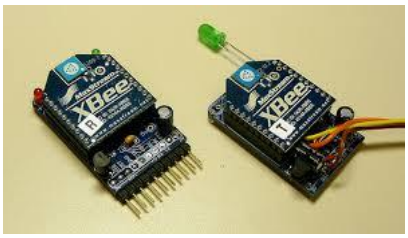

Fig. 2 Zigbee

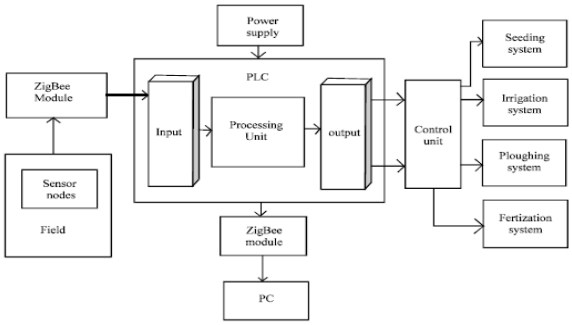


Fig. 3 Block Diagram representing ZigBee processing

D. *Types of Sensor Node*

The total number of sensor nodes used in green house depends upon the size of the green house.200 sensor nodes are sufficient if the size of the greenhouse is 35m*200m.Within this range, sensors can sense the information. There are two types of sensor nodes i.e., type A and Type B where Type A sensors are used to sense the climate outside and Type B sensors are used to sense the climate inside of the Green House which are placed in 10 to 15m of diameter.

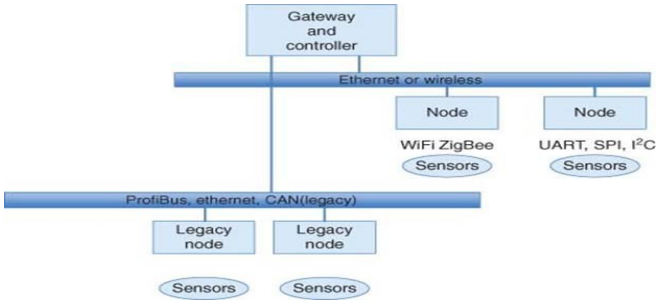


Fig. 4 Hardware design of IoT gateway

*1.* ***Temperature Sensor****:* It is a type of resistor which will vary with temperature which is measured in terms of degree Celsius. The sensor is made up of polymer or ceramic and typically the temperature is achieved between 90 degree Celsius and 130 degree Celsius.
*2.* ***Humidity Sensor****:* It is also called hygrometer. It consists of two metal plates with nonconductive polymer film. This film measures the voltage level between the two plates. The difference in voltage level is converted into digital values**.**
*3.* ***Soil Moisture sensor***: It measures the water content in the soil. Commonly used sensor is frequency domain sensor and it consists of two galvanized wires.
*4.* ***PIC 16F877****:* PIC Microcontroller has inbuilt of memory, CPU and peripheral unit. It is based on RISC based architecture which is fabricated in Complementary Metal Oxide and Semiconductor (CMOS). Its main advantage is low initializing the system is soil moisture, temperature and humidity values calculated?
*5.* ***ZigBee****:* ZigBee is based on IEEE 802.11b standard
technology. It has the advantage of low power usage and it uses fully handshake protocol for reliability. It has two modes which either beacon or non-beacon mode which is used for enabling the data traffic. If the transmission of message is complete, then it moves to next beacon schedule which goes to sleep mode.

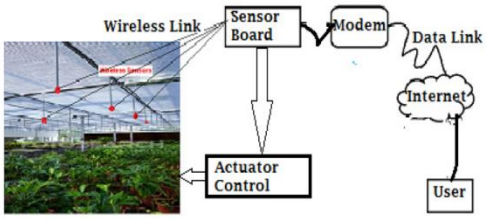


Fig. 5 GreenHouse and Remote Control

## IV. DISCUSSION

In this, Smart Agriculture is implemented using Zigbee technology with IoT technology. The hardware design includes gateway and Zigbee. The IoT is a join point of public network and wireless sensor network in Green House monitoring. The gateway is used to gather information from the sensors and monitor the agricultural field. In this paper, we are using Zigbee transmitter and receiver. All wireless node data and camera data is sent to the gateway. The gateway receives the data, transforms the data and sends the data to control terminal using internet or to smart phone using GPRS. The main objective of WSN sensors is to control the climate as per the crop datasheet. With the help of this, the system will decide the action about the crop.

## V. CONCLUSION

This paper studied about an agricultural environment monitoring server system that integrates environmental and soil sensors into a device to collect information for monitoring the environment at crop plantations, and provides real-time environmental monitoring and various application services based on the information. In this paper, low cost and low power wireless ZigBee technology applies in Greenhouse monitoring system in agriculture. This technology improves its efficiency by using sensor nodes thereby reducing the man power. The Greenhouse monitoring system is designed to satisfy the need of remote monitoring and control of greenhouse , the aim is to realize the greenhouse Environment system. It is helpful to farmers in a scientific and rational way thereby increasing the efficiency of the crop system.

## REFERENCES

[ 1 ] S. R. Nandurkar, V. R. Thool and R. C. Thool, "Design and Development of Precision Agriculture System Using Wireless Sensor Network", IEEE International Conference Automation, Control, Energy and Systems, DOI: 10.1109/ACES.2014.6808017, 2014.
[ 2 ] V. VidyaDevi, G. MeenaKumari , "Real-Time Automation and Monitoring System for Modernized Agriculture", International Journal of Review and Research in Applied Sciences Engineering, Vol. 3, No.1, pp. 7-12, 2013.
[ 3 ] Y. Kim, R. Evans and W. Iversen, "*Remote Sensing and Control of an Irrigation System Using a Distributed Wireless Sensor Measurement"*, IEEE Transactions on Instrumentation and Measurement, Vol. 57, No. 7, pp. 1379-1387, 2008.
[ 4 ] Q. Wang, A. Terzis and A. Szalay, "*A Novel Soil Measuring Wireless Sensor Network"*, IEEE Transactions on Instrumentations and Measurement, pp. 412-415, 2010.