# IMPLEMENTATION OF SMART FARM MONITORING USING IOT

M.Mahendran[1], G. Sivakannu[2], Sriraman Balaji[3]
[1,2,3]Assistant professor, Dept. of ECE , Saranathan College Of Engineering, Venkateswaranagar, Panjappur, Thiruchirapalli

**ABSTRACT**

**An agricultural environment monitoring system provides monitoring services and facility controlling services. This system maintains the crop growth rate in an optimal status. This system also reduces the manpower, time consumption and improves the convenience. The existing monitoring systems are used in an indoor only which is not used in outdoor environment because lagging of IT technology. In addition, when users want to check the monitored information in existing monitoring systems, the user must manually check the status through installed sensors or other terminals. In order to solve these issues, the agricultural monitoring system must be designed such a way that can monitor environmental information and soil information closely and reports the status to remote location. The proposed system monitors the environmental status and the status is sent to agricultural monitoring server then the server sends the data to user. The user analyse the data and if the received data is below the specified value then necessary action will be taken. The whole environment is implemented using IoT. The implementation shown here is simulated.**

**Keywords: IOT, Smart Farm,**

## INTRODUCTION:

With the development of society, traditional forms of agriculture can't satisfy people needs, so agriculture must be changed to satisfy people's needs. the development of internet technology has brought light to the development of agriculture modernization, agricultural internet of things has become the inevitable trend of agriculture informatization. Through the remote monitoring and control of greenhouse, the greenhouse monitoring system can implement the scientific management methods, improve crop disaster prevention ability and increase production.

This paper introduces a kind of agriculture greenhouse monitor system which is low cost, low power consumption and constructed based on short distance wireless communication technology Zigbee. The main objective of the system is to control the climatic condition as per the crop data sheet. The sensors are designed for collecting information about the climatic condition of the greenhouse like Temp, Pressure, Light, Humidity and CO2. With the help of this, system will decide the action about the controls like, fan control, curtain control (product the direct sunlight and sun heat) and sprinkler (to maintain the humidity and temp).

This System is low cost, low power wireless zigbee technology applies in greenhouse monitoring system. It improves the operational efficiency and system application flexibility by using the wireless sensor network instead of traditional wired network, and at the same time reduces the manpower cost. This sytem is helpful to farmers for scientific and rational planting crops. So this design has certain of value to popularize.

Internet of Things (IoT) is an ecosystem of connected physical objects that are accessible through the internet. The 'thing' in IoT could be a person with a heart monitor or an automobile with built-in-sensors, i.e. objects that have been assigned an IP address and have the ability to collect and transfer data over a network without manual assistance or intervention. The embedded technology in the objects helps them to interact with internal states or the external

environment, which in turn affects the decisions taken. IoT systems have applications across industries through their unique flexibility and ability to be suitable in any environment. They enhance data collection, automation, operations, and much more through smart devices and powerful enabling technology. IoT systems allow users to achieve deeper automation, analysis, and integration within a system. They improve the reach of these areas and their accuracy. IoT utilizes existing and emerging technology for sensing, networking, ansd robotics. IoT exploits recent advances in software, falling hardware prices, and modern attitudes towards technology. Its new and advanced elements bring major changes in the delivery of products, goods, and services and the social, economic, and political impact of those changes.

## II. RELATED WORKS

Y.R.Dhumal et al [2] proposes a wireless monitoring and control system for greenhouse based on Zigbee for solving the problems such as poor real time data acquisition, excessive manpower requirement and to overcome the shortcoming of the wired system such as complex wiring. Here we are going to make our own Visual Basic Software Web Server which will communicate with the other devices such as Android mobile phone using synchronizing software (TEAM VIEWER). This software will keep all the devices in sync with the server. A wireless camera is attached to monitor in real time also the devices can view the required information anywhere from the world as these devices are connected via Internet enabling owner to check and control in a real time manner .The information is also updated to the user through SMS service. The proof-of-concept design applies commodity computing integrated to legacy data logging devices, ensuring cost-effectiveness and simple integration.

Control of various environmental parameters artificially is of utmost importance to increase crop yield and productivity. Fig. 1 shows the parameters, Light, Soil Moisture, Humidity and Temperature are monitored and controlled using ARM processor, transmitted through the Zigbee to the VB based web server and then to the android mobile phone via a WI-Fi or internet connection. Thus an efficient, low cost and reliable method is used to implement the same with the TEAM VIEWER software.

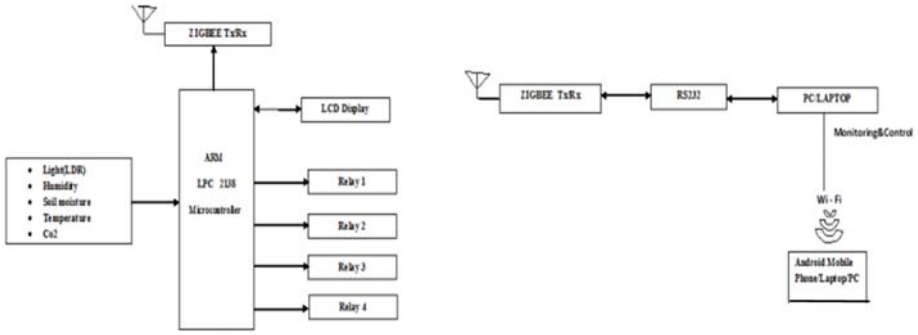


**Fig. 1 Block Diagram of Greenhouse Automation**

Vaibhavraj S. Roham et al [7] proposes an automation system to trace down the local climatic condition parameters (like CO2, Temperature, and Humidity) at different locations. Wireless Sensor Networks (WSN) does this job to automate and analyze the corresponding parameters. We are going to develop the Web Application, Smartphone Application and Sensor Network using Zigbee Devices, BeagleBone Controller and various Sensors. Fig. 2 shows the block diagram of Smart Farm using WSN and the description of each module are explained below.

### Green House

Green house is the field position where we are going to deploy and test for various climatic parameters by proposed system.

### Sensing Node

Various sensors like CO2, Temperature and Humidity are attached to sensing node. Sensing node will read the values by regular interval and forward it to routers. Sensing Nodes are XBee Devices which are configurable for various sensors. XBee devices are capable of working on Solar Power as well as storage batteries. These devices are remotely configurable.

**Routers**
Routers are the XBee devices which work independently, accept the various reading from sensor nodes and forward the values to coordinator. This is also capable to operate on solar power and storage batteries. Even though routers are optional part in the network because sensing node can directly send the values to coordinator / gateway.

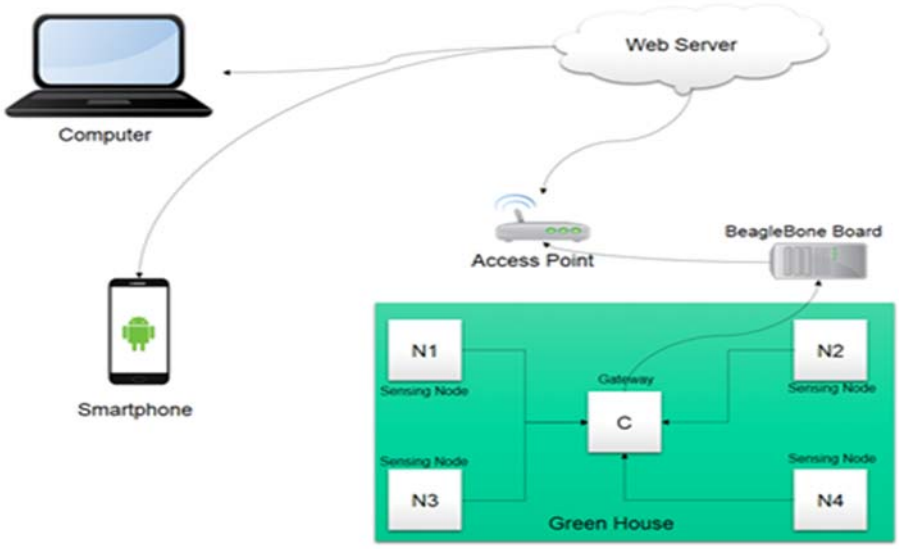


Fig. 2 Block Diagram of Smart Farm using Wireless Sensor Network

**Coordinator (Gateway)**
Coordinator is XBee device which accept values from various routers and sensing nodes. Coordinator is connected to BeagleBone which is connected to internet. All the accepted values will be sent to BeagleBone for processing by serial interface.

**BeagleBone (BB)**
BeagleBone is the small device powered by Debain Operating System. We can perform all operations which we can perform using any computer device. BB will communicate with gateway/coordinator by serial interface. The python API will regularly check for frames or values on serial port because coordinator will be sending all the values on serial port of BeagleBone. As BB is computer device we can connect internet to it via Ethernet port or Wi-Fi/ Wireless LAN. BB will access the API from webserver and dump all the readings into database.

**Access Point**
Access point is simple router which will provide internet connectivity to BeagleBone Board. Even if we are using local webserver we can provide connectivity via router to BB.

**Web Server**
Webserver will have a database and specific API from where the BB can connect and store values in database remotely. API and all will be developed by using MVC Framework in PHP and Some Python Scripts. Webserver analyzes all the incoming values from the BB and analyze them, if any instant change is observed the farmer will be acknowledge by SMS, Email and Notification on Mobile Application.

**Computer/Web Application**
Web Application can be accessed from any Internet enabled device from which we can continuously monitor the greenhouse. Graphs, Charts and History are used for effectiveness. Even web application will be in multi-language support because of which any farmer can effectively use it. Web application will be hosted on webserver. From web application we can remotely configure any XBee device such as switching ON OFF at any time. Web application will periodically analyze the values and predict some actions depending on the conditions.

**Smartphone Application**
Smartphone app designed in Android will be connected to Internet i.e. specifically to webserver. As webserver will be connected to webserver same this application will be working.

From Smartphone we can monitor the environment continually without manual monitoring. Even all the remote devices are capable to configure remotely from application.

## III .PROPOSED SYSTEM

The greenhouse monitoring system is designed to satisfy the need of the remote monitoring and control of greenhouse, the aim of the system is to realize greenhouse environment system, the system can improve the efficiency of environment room management and reduce the human resources investment and save energy. It is a typical IOT system based on B/S structure. It includes perception layer, network layer and application layer. CC2530 is used as the processing chip of the wireless sensor nodes and the coordinator, Zigbee technology is adopted in wireless communication, the gateway uses the Coretex- A8 processor and Linux operating system as the core [1].

In this system, the network topology model of zigbee is satellite. The zigbee coordinator is the organizer of zigbee network. It receives the wireless sensor nodes information and sends the information to the room gateway through the serial port. The server transplanted in the gateway receives the user's request and disposes the information by the CGI program and feedback the processing information to control and display terminal.

The main objective of WSN system for agriculture greenhouse is to control the climatic condition as per the crop data sheet. The sensor is designed for collecting information about the climate of the green house like temperature, pressure, light, humidity, CO2, wind speed and wind direction. All these parameters gives the outside world information about the climate. With the help of this, system will decide the action about the controls like in out air flow control, screen control (protect the direct sunlight and sun heat) and sprinkler (to maintain the humidity and temperature).

## SYSTEM DESIGN

System design is the process of defining and developing system to satisfy specified requirements of the user. Fig. 3 shows the proposed system architecture. The architecture contains Plant Module, Sensor module, Processor Module and Actuator Module.

## MODULE DESCRIPTION

### Plant Module

For each crop the user enters the crop details such as crop name, date of report, temperature, light, CO2 values.

### Sensor Module

The sensor is designed for collecting information about climate of the green house. Three different types of sensors are used to collect climatic conditions. Temperature Sensor is used to collect Temperature Value. Light Intensity Sensor to detect the Light Value and NDIR Sensor used for collecting CO2 Value [1].

### Processor Module

Checks all sensed information's were up to the necessary limit for each crops. If all data's are normal, the processor continues its work. Otherwise, it activates the actuator to take corrective actions to control the environmental conditions. And also sends the sensed data's to user via Internet.

### Actuator Module

Decides the action about controls like in out air flow control, screen control (protect the direct sunlight and sun heat) and sprinkler (to maintain the humidity and temperature).

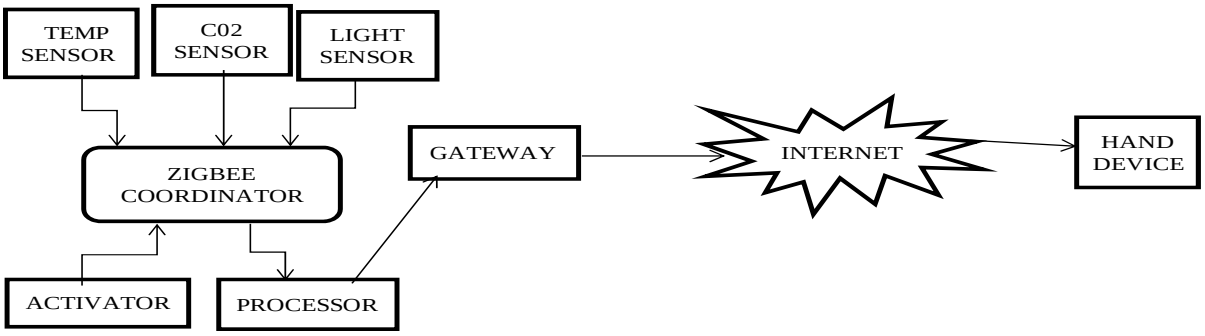


Fig.3: Proposed System Architecture

## FLOW DIAGRAM

A Data Flow Diagram (DFD) is a graphical representation of the flow of data through an information system, modeling its process aspects. Often they are a preliminary step used to create an overview of the system. DFD's can also be used for the visualization of data processing. Fig. 4 represents the data flow diagram for the proposed System

.

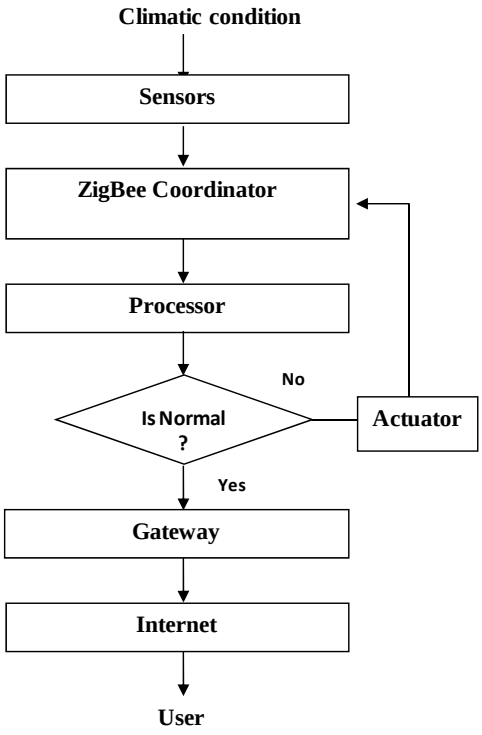


**Fig. 4 Dataflow Diagram for Proposed System**

## IMPLEMENTATION

The Implementation is done in simulation using Java swing. In Fig 5 shows the main window contains Image details, Date and Environmental details. Fig. 6 shows the Sensor Module which displays the detected sensor values of CO2, light and temperature. The processor module displays table of sensor detected values and initiates or terminates the process of actuator and it is shown in Fig. 7. The fig. 8 and 9 indicate various actions taken by the actuator depending on the sensor values. Updating the sensor data to the user phone through message is shown in the fig. 10.

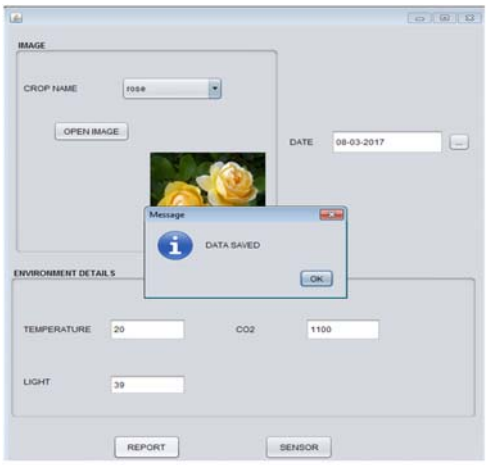


**Fig. 5 Plant Module**

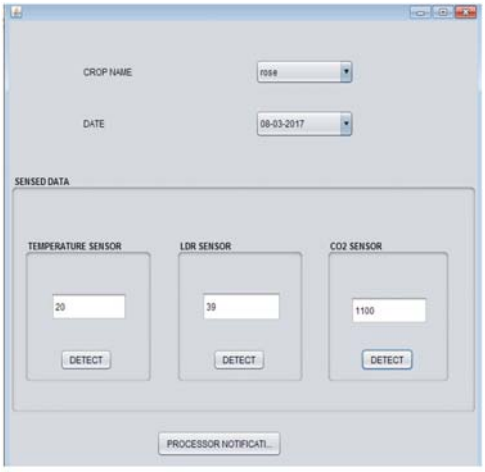


**Fig. 6 Sensor Module**

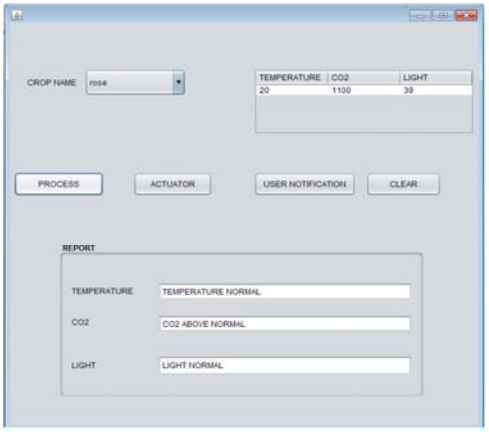


**Fig. 7 Processor Module**

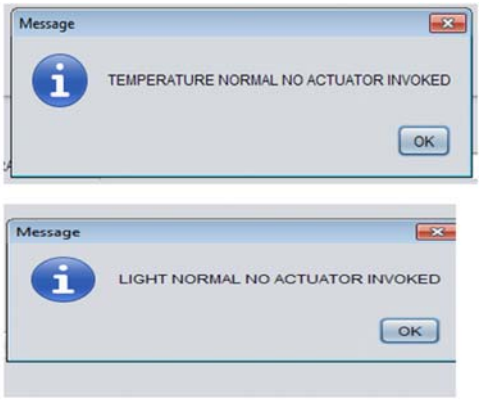


**Fig.8 Actuator not invoked**


**Fig. 9 Actuator Invoked for CO2**


**Fig. 10 User Notification**

## CONCLUSION

The proposed system aims to reduce cost, power. The system realizes the remote intelligent control to the room equipment through Internet. It improves the operational efficiency and system application flexibility by using the wireless sensor network instead of the traditional wired network and at the same time reduces the manpower cost. The practical application approved that the gateway run fine in the green monitoring system, the environment data of the greenhouse can transfer reliably and the control instruction sent timely. This design realizes remote intelligent monitoring and control of greenhouse and is helpful to farms to scientific and rational planting crops.

## FUTURE WORK

This work can be extended to support different types of climatic conditions to improve the growth rate and reduce the manpower.

## REFERENCES:


1. LIU Dan, Cao Xin, Huang Chongwei and JI Liangliang, "INTELLIGIENT AGRICULTURE GREENHOUSE ENVIRONMENT MONITORING SYSTEM BASED ON IOT TECHNOLOGY ," Proc. 2016 International Conference on Intelligent Transportation, Big Data & Smart City.

2. Y.R.Dhumal , J.S.Chitode "Green House Automation using Zigbee and Smart Phone ," in International Journal of Advanced Research in Computer Science and Software Engineering , Volume 3, Issue 5, May 2013 ISSN: 2277 128X .

3. AshwiniBhosure, MayurBhosure, Rakeshkumar Sharma," Web Based Greenhouse Environment Monitoring and Controlling System using Arduino Platform", in International Journal of Scientific Engineering and Applied Science (IJSEAS) – Volume-2, Issue-2, February 2016 ISSN: 2395-3470

4. Shubhangi Ghatage , Snehal borate, Rupali Kale, Prof. R. Rashmi, "

Greenhouse Surveillance System Using Smart Phone ", in International Research Journal of Engineering and Technology (IRJET) Volume: 03 Issue: 03 , Mar-2016 e-ISSN: 2395 -0056 .

**5.** Li Zhang, Congcong Li, YushenJia, Zhigang Xiao "Design of Greenhouse Environment Remote Monitoring System Based on Android Platform",in CHEMICAL ENGINEERING TRANSACTIONS , VOL. 46, 2015

**6.** Jeonghwan Hwang, Changsun Shin and Hyun Yoe ," Study on an Agricultural Environment Monitoring Server System using Wireless Sensor Networks ",in Sensors 2010, 10, 11189-11211; doi:10.3390/s101211189

**7.** Vaibhavraj S. Roham , Ganesh A. Pawar , Abhijeet S. Patil , Prasad R. Rupnar ," Smart Farm using Wireless Sensor Network ",in International Journal of Computer Applications (0975 – 8887)