# Efficient Wireless Data Transfer For Real Time Greenhouse Management Using Ieee 802.15.4/Zigbee Protocol

**K.Kothavari, N.Praveen Kumar, S.SibhiPrasanna, S.Ramachandar, E. Vijay Antony, P. Pradeep**

***Abstract***— This paper provides the practical solution for real time greenhouse management system using wireless data flow control, using labVIEW one can remotely monitor for each node assigned and the data can be acquired so with respect to the user provided set values, corresponding control instructions is transmitted form remote area/unit to control area. After the control action the node unit keeps on monitoring the chamber the status is updated and stored in spread sheet with the help of labVIEW. By this approach user possibly use proper resources which gives maximum yield throughout the year and a case study can be made by analysing the plant growth at different environment levels , these levels can be assigned and maintained by user.

***Keywords*** —**Horticulture, Wireless Network Protocol, Wireless Sensing Node, Pest and Pathogen Management, LabVIEW, ZigBEE Transceiver(CC2500),PIC Microcontroller(16F877A).**

Ms.K.Kothavari is working as Associate Professor, Department of Electronics&Communication Engineering, *Dr.NGP Institute ofTechnology, Coimbatore-641048,TamilNadu, India and* [2]N.Praveen Kumar, [3]S.SibhiPrasanna, [4]S.Ramachandar, [5] E. Vijay Antony, [6] P. Pradeep*UG students,* Department of Electronics&Communication Engineering, *Dr.NGP Institute ofTechnology, Coimbatore-641048,TamilNadu,*

## I INTRODUCTION

In our day to day life agriculture plays a vital role, the quality and cost are the major problem in food products, there is a greater demand for food product due to drastic population growth, our world population is expected to reach 9.1 billion people by 2050, Agricultural production demand increases rapidly (survey by MICCA). The environmental issues such as temperature, humidity, soil and pest are the factors affect the crop growth and productivity.

With the help of virtual tool such as **LabVIEW**, embedded with sensors, the proposed design is to measure, acquire and control user required parameter. An autonomous system contribute improved andconstant yield.

## II EXISTING SYSTEM ANALYSIS

To develop an efficient control system the concepts and ideas where obtained by analysing the papers, which gives idea on monitoring system[1], solar power energy harvesting[1] which helps to have an effective design,System gives idea on water management [2] which is compared in table 1.1.

By referring the mentioned papers efficient control system is designed for real-time greenhouse.

### A.Problem Identified

- Measured parameter are not controlled (**Real time readings are observed**) [1], [5].
- The storage depends on web server (**Real time data directly transmitted for a central data base)** [1], [7], [6].
- The data transfer rate as the distance increases [2]
- Loss of packets (**For every 20 nodes, 8 nodes have complete loss of packet approx. 40% packet loss**) [3].
- Time scheduling problem occurs (**due to broadcasting, collision occurs**)[4]
- Absence of precise prediction algorithm for calculating the **risk index**[3],[6]
- Time delay due to inefficient data transfer needs **compression algorithm**[3]

### B.TABLE 1.1 SYSTEM COMPARISON

## III PROPOSED SYSTEM

The greenhouse monitoring and control system based on WSN includes monitors the chamber and control actuators. Sensor nodes are deployed in greenhouse wherever, and preside periodic collection greenhouse environmental message and transmit to control centre, it is constituted by Indoor wireless unit, Outdoor wireless unit, Remote unit. These data are handled and analysed when control centre gains, then relevant decisions are made and send control message to greenhouse control unit by LabVIEW, which regulate greenhouse environment parameters to obtain best growth environment for crops.

- The control algorithm is developed for maintaining temperature, humidity, and soil moisture.
- The complexity is to Developing a greenhouse remote monitoring system that does not require manual changes with each crop change.

The proposed system approaches

- Monitoring
- Data acquisition
- Control

### A.Node Unit

Each Electronic zone node(EZN) consist of PIC16F877A with the ZigBEE CC2205 transceiver use to transfer the temp, humidity and, soil wetness data with the help of LM35,HSY220 and conduction wires for soil wetness as shown in figure 1.4. LM35 have no normalization and it gives linear output, based on the conductivity the varies voltage level determined for different level of soil moisture and moreover comparing to wilting point the conduction rods placed for each one feet distance from ground which helps to identify the wetness with respect to depth. The collectively binded data are transmitted to PC unit.

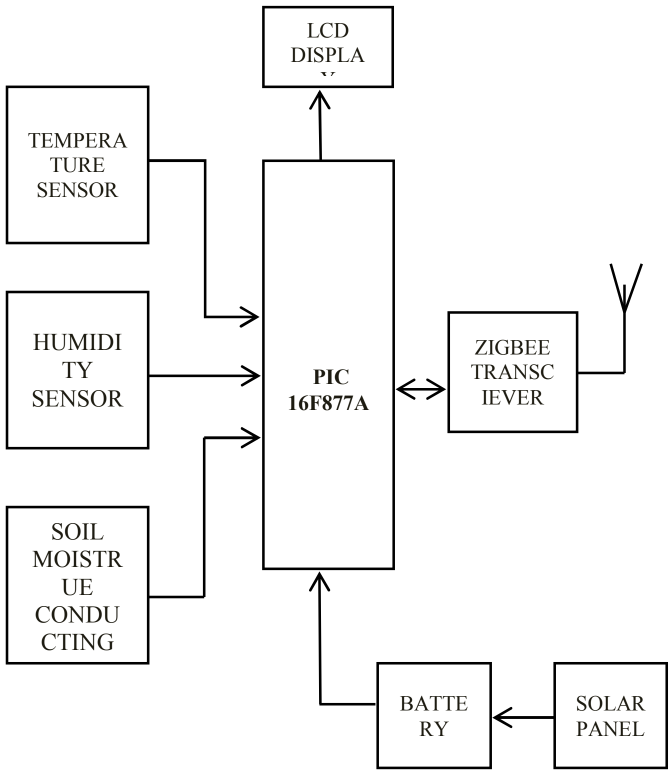


**Figure 1.4 Block Diagram of Node Unit**

### B.MONITORING

The initial step is monitoring every user supposed to monitor the status of the chamber unit, the number of chamber have each node and actuators to control.As shown in block (figure1.1) the sensors receives the analog input which corresponding voltage is generated as given below. Similarly each unit generates the voltage which is normalized value for output. These data where grouped

| Data | REFERENCE PAPER | | | Proposed system |
|---|---|---|---|---|
| | [1] | [5] | [2] | |
| Technology | Ad-hoc | Wireless communication | Wireless sensor network | Control system |
| Hardware | wi-max | Mc system stc12le5410 ad (8051)gsm | Plc, Freescale low-power microcontroller unit | Pic controller (16f877a) |
| Software | Simulating mac protocol | Visual basic | Scada tool Can(controller area network) protocol | Mp lab v4.2 |
| Features | Solar radiation wind speed and leaf wetness Centralized database. | Extinction of field area is possible | Quality of water distribution in green house | Processing delay (approx. 2 min ) |

and transmitted with ZigBEEcc2205 (20m range). As shown in block diagram the sensors where interfaced in pin 2, 3, and4 the corresponding pin configuration is shown in figure 1.5.

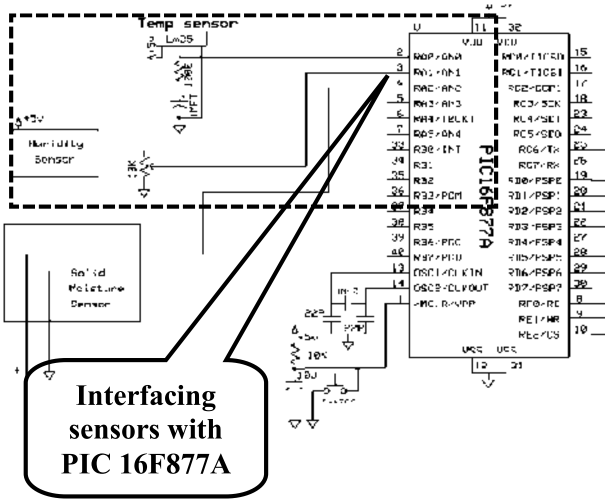


**Figure 1.5 Sensor Interfacing**

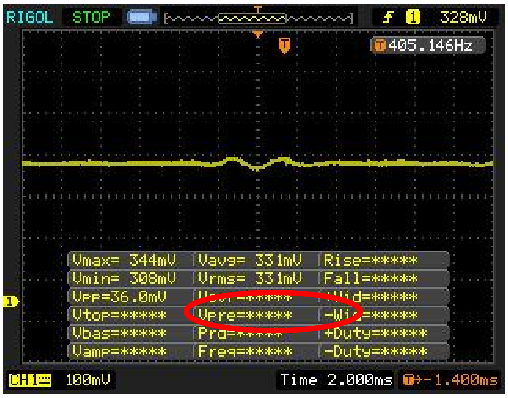


**Figure 1.6 Analog Output of Temperature Sensor**

The sensor output values where acquired and the corresponding test result of temperature sensor is shown in figure 1.6.


**Figure 1.7 (a) Analog Output of humidity Sensor**

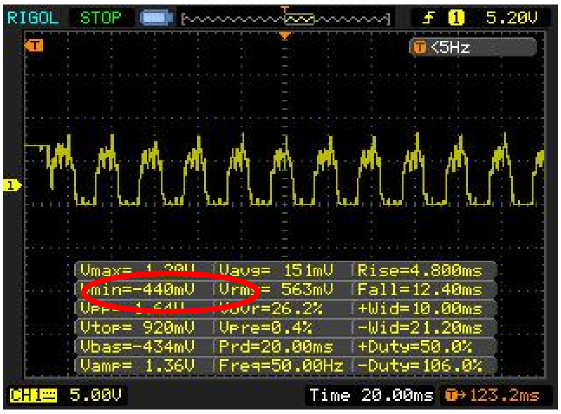


**Figure 1.7(b) Analog Output of soil moisture sensor.**

The sensor output values where acquired and the corresponding test result of humidity and soil moisture sensor is shown in figure 1.7(a) and (b).

Thesedata where bundled and transmitted by 8 bit to the PC unit with the priority assigned to the controller and the values where obtained in LabVIEW as given below.

**C.PC Unit**

The obtained values from EZN where acquired to PC via USART serial communication, as shown in the figure 1.8.The each zone values are obtained these values are compared with the measured value.

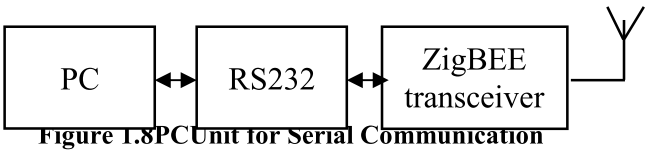


**Figure 1.8PCUnit for Serial Communication**

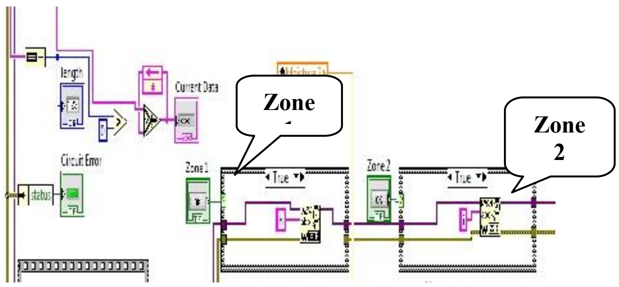


**Figure 1.9 Zone value acquisition by LabVIEW**

The assigned two zones where indicated in figure1.9 and the initial values are assigned as shown in figure 1.10.

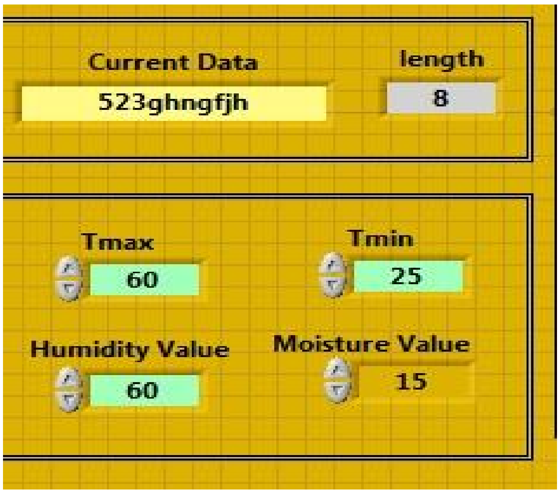


**Figure 1.10 user defined set value**

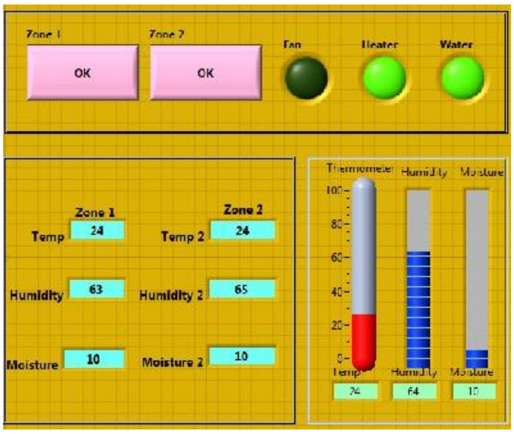


**Figure 1.11 obtained net value from chamber**

Further the vales obtained as shown in figure 1.11 is compared with the user provided data, here its processed with the sample data which is given detail in control unit.

**D.Control Unit**

The control unit provided with corresponding control algorithm, to trigger the actuators and to maintain the chamber environment as block shown figure 1.12

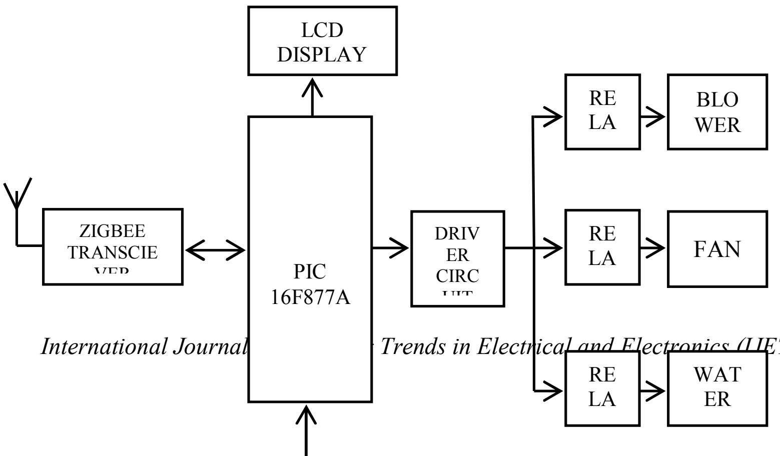


**Figure 1.12 Control Block Unit**

LabVIEW acquire process and provides the precise control action to the control unit, which flow is given in following table.

Table 1.2 is the obtained value from the field, these values where compared and the control action is taken which is indicated in figure 1.13.

**Table 1.2 Values Obtained from Each Zone**

| Temperature($^{o}$C) | Humidity(%RH) | Soil Moisture (%) |
|---|---|---|
| 24 | 64 | 10 |

**Table 1.3 User Defined Value/ Required Value**

| Temperature range ($^{o}$C) | Humidity(%RH) | Soil Moisture (%) |
|---|---|---|
| 25-60 | 60 | 15 |

**Table 1.4 Corresponding Control Action**

| Blower Condition | Cooling Fan Condition | Sprinkler Condition |
|---|---|---|
| ON | OFF | ON |

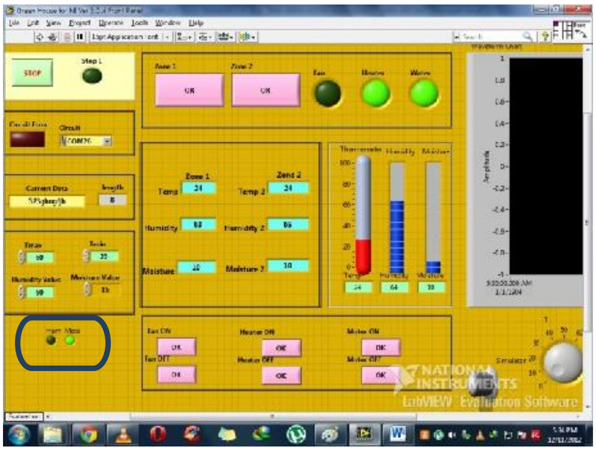

**Figure 1.13 LabVIEW front panel**

**E.Data Output**

The two zone acquisition is done in this system which is implemented. In this, temperature values from the each zone are stored in the data base sheet in LabVIEW .The measured values are plotted and represented in the graphical format as shown in the figure

**FConfiguring with LabVIEW**

For data logging the LabVIEW is configured as shown in figure1.14 in such a way the each parameters are stored in excel sheet and graph is plotted as shown in figure 1.15.

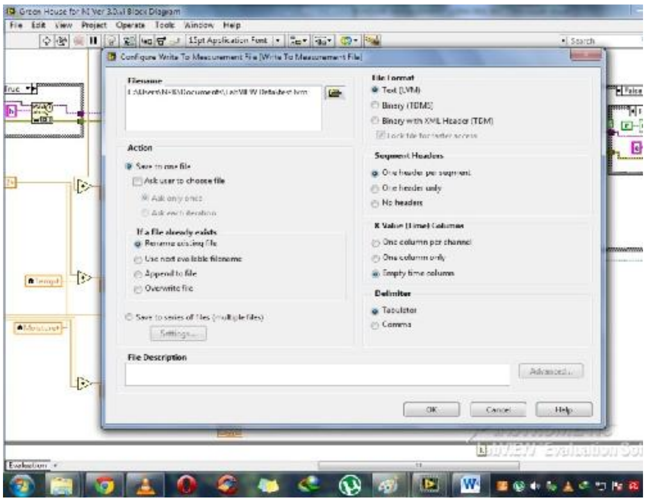

Figure1.14 configuring the data logging using spread sheet

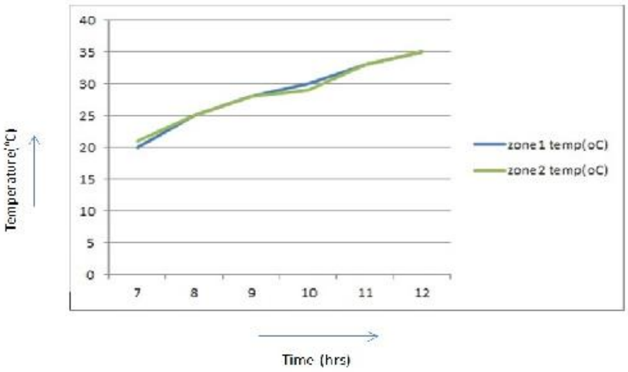


Figure1.15 the data out from the stored data base

The time interval and length of the number of actions taken is stored in excel sheet simultaneously in each file as shown in figure1.16

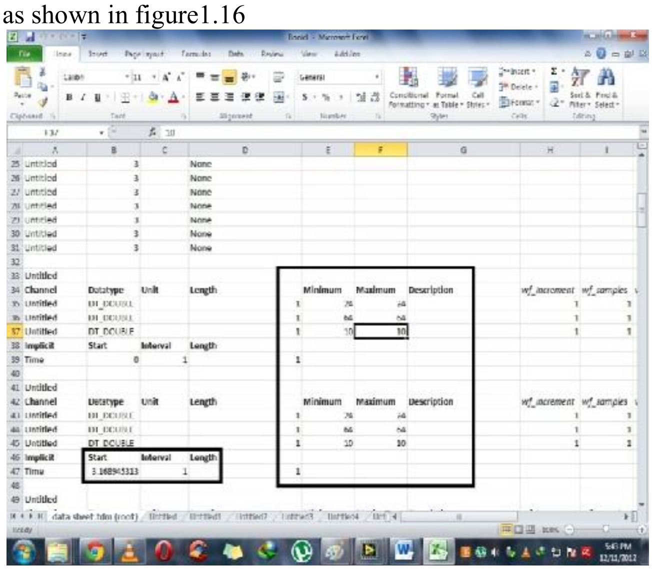

Figure1.16 the data stored in spread sheet

This the final or net output for one sample of data, where the number of case study can be made for different crop unit in a chamber as shown in figure1.17

Figure1.17 green house chamber

Where the proposed system is compared with the existing system as shown in table 1.5

The system can be enhanced by adding the input parameters such as acquiring pH value from soil, the integrated pest management using image processing and the present remote monitoring can be enhanced by sharing data with network cloud using LAN protocol, it can be adopted to solar dryer chamber and also for outdoor field monitoring.

## IVCONCLUSION

| S.no | Existing system | Developed system |
|---|---|---|
| 1 | System features half duplex communication [1] | System features full duplex communication |
| 2 | Solar provides 10W, 0.67 Ah/day[1] | Solar provided with 16W. |
| 3 | Data bit rate decreases with increase in bus rate(CAN) [2] | Gives reliable data delivery in 20m(ZigBEE) |
| 4 | Does data base management [1] | System have database management as shown in figure 1.16 |

**Table 1.5: Result Comparision**

This proposal is going to compensate the present agricultural demands, Maximum yield can be obtained with diverse climatic conditions. The **20 – 30%** of yieldcan be increased by maintaining environment condition

System is versatile and more reliable, The purpose is to validate the different biological models used for horticulture applications This system remarkably reduces the communication cost of data collection with reduced error bounds and This new system will bring a new era in the field of greenhouse agriculture.

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## BIOGRAPHY

Ms.K.Kothavari: She has completed Bachelor Of Engineering in Electronics &Communication Engineering by 1990 from Madurai Kamaraj University. She received Master Of Electronics Engineering in Applied Electronics by 2004 from PSG College of Technology, Coimbatore under Anna University, Chennai, She is pursuing P.hD in Image Processing. She is currently working as Associate Professor in Dr NGP Institute of Technology , Tamilnadu, India. She has 12years experience

Technology, Coimbatore 641048, TamilNadu, India. Interested in Embedded system and wireless networks

U.G.Student Department of Electronics& Communication Engineering, Dr.N.G.P. Institute of Technology, Coimbatore 641048, TamilNadu, India. Interested in Embedded system and wireless networks

U.G.Student Department of Electronics& Communication Engineering, Dr.N.G.P. Institute of Technology, Coimbatore 641048, TamilNadu, India. Interested in Embedded system and wireless networks

U.G.Student Department of Electronics& Communication Engineering, Dr.N.G.P. Institute of Technology, Coimbatore 641048, TamilNadu, India. Interested in Embedded system and wireless networks

U.G.Student Department of Electronics& Communication Engineering, Dr.N.G.P. Institute of Technology, Coimbatore 641048, TamilNadu, India. Interested in Embedded system and wireless networks