Controlling of Green House Parameters through GSM and LabVIEW System

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Abstract— This thesis provides design and implementation details of controlled environment agriculture. Different sensors and instrumentation system used in the controlled environment agriculture has been discussed in details. A fuzzy logic based inference system has been developed to control the water flow for drift irrigation system. . After acquiring these three parameters we introduce GSM technology which will help to make communication with farmers. GSM will send alert message to the farmers cell phone. Microcontroller based design and implementation has been shown. LabVIEW based application has been developed to monitor critical parameters of the controlled area environment problem.

Key words: GSM & LabVIEW System, Green House Parameters

I. INTRODUCTION

To meet the huge food grain requirement of 480 million tonnes (Mt) by the year 2050, with increasing challenge of biotic and abiotic stresses experienced by crops, introduction and adoption of modern technology in Indian agriculture is inevitable. Agriculture, like other industries, has made entry into knowledge-based era, leaving its previous resource based nature. Future agriculture will be severely competitive, knowledge intensive and market driven. WTO agreement and liberalization of agricultural trade has not only created new scopes but also new threats to Indian agriculture. Removal of quantitative restrictions on import form 1st April 2001, made quality and cost competitiveness as two most important factors to sustain in globalized market. Unlike the Green revolution of India, which was supply driven, the future agriculture will be demand driven. The high cost of production and low productivity, even though we produce large quantity of yield, will throw Indian farmers out of the economic competition arena of free market.

II. LITERATURE SURVEY

Nilimamayee samal and Umesh chandra Pati have presented Multichannel Data Acquisition where they have used LabVIEW platform to do monitoring and controlling of surrounding temperature, pH value of water. For the measurement of temperature thermocouple is used and if the temperature increased to a certain level then fan is ON and temperature decreases to that level then heater will be ON[1].

pH value is measured in the form of voltage so the conversion formula is used and later convert voltage reading into pH reading. As measured liquid, if it has higher or lower pH value then valve is open acidic or alkaline. The concept of remote monitoring in agricultural greenhouse using wireless sensor and short message service (SMS) was presented by Izzat Din Abdul Aziz et.al, in which GSM technology was used to send message and to alert the workers through the users mobile phone, if the data exceeds the threshold value set by farmers then an alert SMS will be send via GSM modem to farmers mobile phone[6].

In one of the research paper a wireless sensor networks was design for greenhouse automation where three commercial sensor was used to measure three parameters temperature, light and humidity and also a hardware MICAz (2.4GHz) was used, IEEE802.15,CC2420 802.15.4 RF-transceiver, CC1100 RF-transceiver, CC2430 RF transceiver are used for enabling low-power wireless sensor networks [7]. In this project CC2510 RF transceiver was used as wireless communication module sensor nodes are hanged into plants which sense the environmental condition and send it to base station[8,9].

Design of real Time Data Acquisition with Multi Node Embedded System was presented by Mukesh Kumar, Sanjeev Sharma and Mansav Joshi in their work a real time data acquisition was used to measure some parameters and hardware was used for sensors, analog to digital converter to convert analog to digital data that will process by slave processor, graph of acquired signal is display on LabVIEW through CPLD[5].Digitally Greenhouse Monitoring and Controlling of System based on Embedded System was presented in one paper where temperature, humidity and light is controlled through ADC, MC, LCD and actuators software used is Keil Micro Vision[10]

Nungleppam Monoranjan Singh and Kanak Chandra Sarma have presented their work as design and development of low cost pc based real time temperature and humidity monitoring system where pc based data logging was used which was very cheap compared to DAQ cards used in laboratories. The design system was connected to PC through RS-232 serial port with the help of this continuously monitoring and soring of data to PC is possible [2,11,12,7]

Development of a data acquisition and greenhouse control system based on GSM is presented by A. Rahali, M. Guerbaoui, A. Ed-dahhak, Y. El Afou, A. Tannouche, A. Lachhab, B.Bouchikhi, where there main concern is to do remote monitoring using GSM technology. All sensors and actuators are directly connected to computer system through DAQ card PCL812PG and GUI based on LabVIEW is used to monitor these parameters temperature, humidity and soil moisture[13,14].

To data logging and post processing the hardware like measurement card, control card, drip irrigation station and software were used in some papers and GSM for sending sms, Virtual instrument, blue tooth technology and also RF technologies were used[15,16,11,17]. Design of remote data acquisition system based on 3G was presented in one research paper where data logging function is demonstrated using GSM 3G technologies and in which the transmission speed of 3G technology was 2Mbps so bulk data can be transfer i.e., send large volume of videos ,image and sound[18,19]

L.V. Didhe, Dr. J. W. Bakal, Prof. S.V. Kulkarni worked on android based system where they controlled the green house parameters via smart phone or tab[25].

A fuzzy logic based irrigation system enhanced with wireless data logging applied to the state of Qatar is published by Farid Touati, Mohammed Al-Hitmi, Kamel Benhmed, Rohan Tabish where they explained the concept of practical solution based on intelligent and effective system for a field of hyper aridity in Doha–Qatar[26].

A fuzzy irrigation controller system by M. Bahat, G. Inbar, O. Yaniv, M. Schneider where they are focusing on the simplicity in designing and constructing such a system and other advantages of using fuzzy logic in the feedback control problem[27].

A Fuzzy Decision Support System for irrigation and water conservation in agriculture by E. Giusti , S. Marsili-Libelli they works on improvement of an existing irrigation web service, based on the IRRINET model, by describing a protocol for the field implementation of a fully automated irrigation system[28].

III. SYSTEM MODULE

Temperature is measured through wireless temperature sensor, through LM35, Humidity is measured by DHT11 sensor and barometric pressure is measured by BMP180 sensor. These three sensors are connected to the Arduino microcontroller. GSM (Globle System for Mobile Communication) is interface with Arduino .These will send message to farmers mobile phone which contains value of temperature, humidity and pressor.

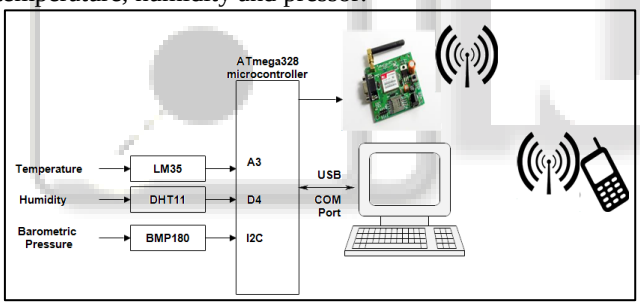


Fig. 1: System Module

Fig. 2: System Block Diagram of Intelligent Supervision of Greenhouse parameters

A. *Arduino*

Arduino is electronics circuit based on microcontroller and easy to-use as hardware and software. Arduino board takes signals from input sensors and connected to the fuzzy logic controller for controlling as shown in the figure 3 and figure 6. The Arduino is designed in such a way that it is very easy to understand. The objects built with Arduino respond to sound, control light, touch, and movement etc. Here we are taking three parameters that is temperature, pressor and humidity. It is best suited for its hardware but its software that is set of instructions is also required to program hardware. The hardware and the software both include "Arduino." The combination of both hardware and software of Arduino issued in our project.

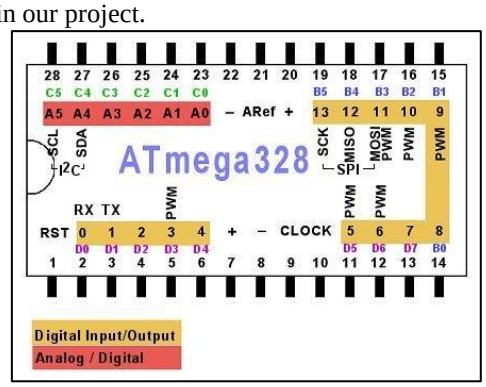


Fig. 3: ATmega 328 Block Diagram

B. *Fuzzy Greenhouse Control*

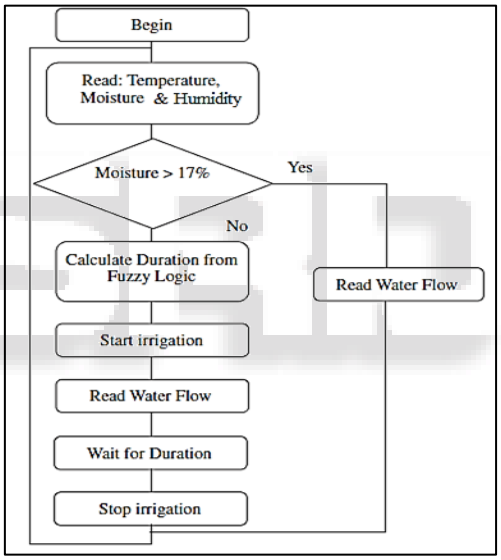


Fig. 4: Flow chart of irrigation system.

For fuzzy logic control system the Mamdani fuzzy inference mechanism is used. When applying Fuzzy Logic to the control of systems Mamdani fuzzy inference is useful if system is classic feedback. A frame diagram for a fuzzy control greenhouse system is show in figure. Two input variables of fuzzy controller are given as, $\Delta T = T_s - T_{in}$ (Ts: set-point temperature, Tin: inside temperature), and $\Delta RH = RH_s - RH_{in}$ (RH_s: set-point humidity, RH_{in}: inside relative humidity). The discrete nature of the staged heating/ ventilating equipment is the main problem while implementation of fuzzy controller. For temperature, controlling there is no need of mathematical model of fuzzy logic controller but the main thing is input and output relation between greenhouse parameters. In this part, MATLAB and PC-based LabVIEW was used to implement a fuzzy logic-based temperature control greenhouse. The controlling of temperature is done by regulating the heater and fan. The fuzzy controller has to make decisions based on difference between set-point and measured inputs variable. The variable "temperature" is divided into a range of three states such as

"Cold", "Moderate" and "Warm". An arbitrary threshold might be used to separate "Cool" from "Warm", but this would result in a discontinuous change when the input value passes over that threshold. The way to make the states "fuzzy" is to allow them change gradually from one state to the next is gotten by experience.

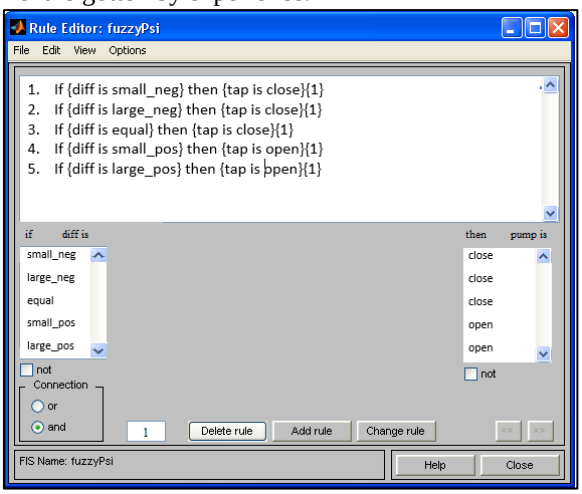


Fig. 5: fuzzy rule sets of irrigation system.

C. Fuzzy Control and Monitor

A fuzzy logic for greenhouse temperature control has been developed using LabVIEW. The software is based on the graphic user interface (GUI). It having text box which is used for user to monitor and control of parameters (temperature and humidity). It also features to enter the new set point; filename to store measured data…etc. The dashboard of fuzzy control and monitoring is shown in figure 6.

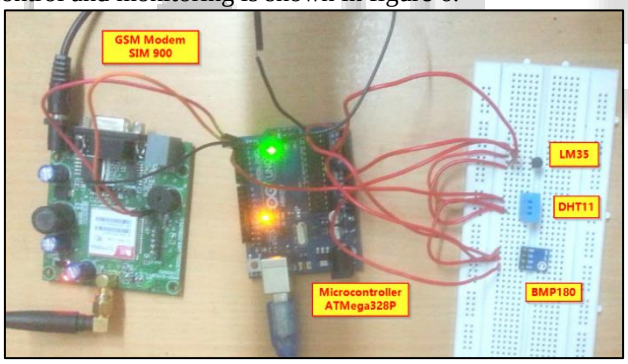


Fig. 6: The dashboard of climate fuzzy control and monitoring

The driving software enables us to fix thresholds of temperature and humidity. However, the combination of fuzzy controller and LabVIEW software has not been presented thoroughly the process control in greenhouses. This work discusses the design and practical implementation of a computer-based control system that integrates fuzzy control techniques. The system was designed to accurately regulate in real-times three environmental parameters (i.e. humidity, temperature).

IV. WIRELESS DATA ACQUISITION IN A GREEN HOUSE

NI-WSN 9791 gateway is a programmable Ethernet gateway that connects remote WSN nodes to a computer for data acquisition and control. The NI-WSN 3202 and the NI-WSN 3212 nodes are programmable wireless receivers, which has several analog and digital inputs.

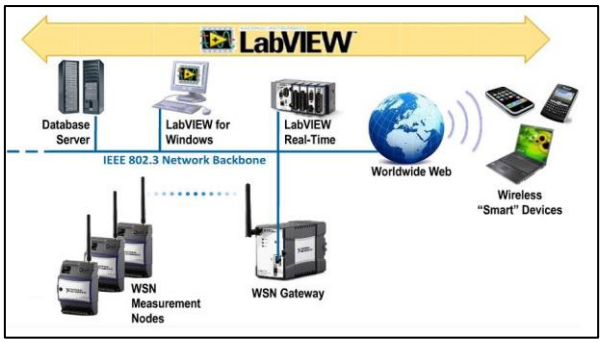


Fig. 7: LabVIEW based setup of various required sensors network

V. RESULT AND ANALYSIS

Fig.8 illustrates the output result from the experimental setup developed for CEA. This comprises of a microcontroller (ATmega328P), a GSM module (SIM 900) and sensors.

The GSM module sends SMS to the user in regular interval about the status of the environment.

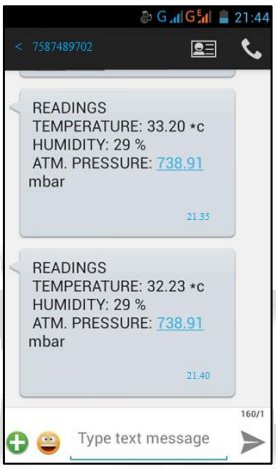
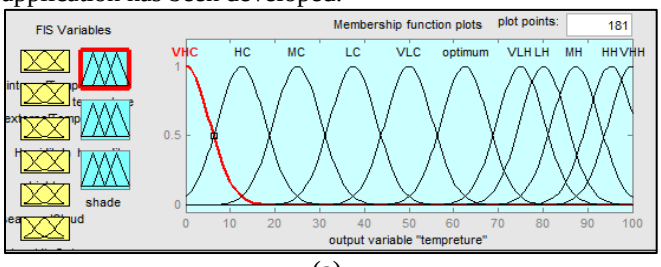
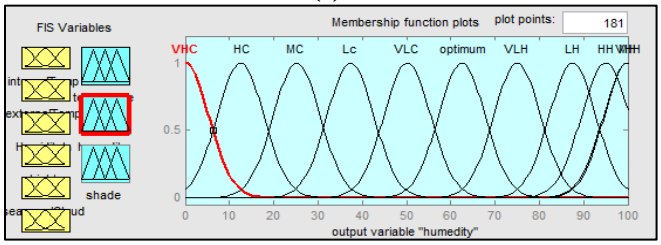


Fig. 8: Screen shot of SMS received.

Figure 8: Closed loop control of heat exchanger system Apart from GSM communication, the sensors and the microcontrollers are connected with a PC using serial communication and LabVIEW program is used to monitor the status of the CEA. The serial communication is achieved using VISA communication protocol. An LabVIEW based application has been developed.



(a)



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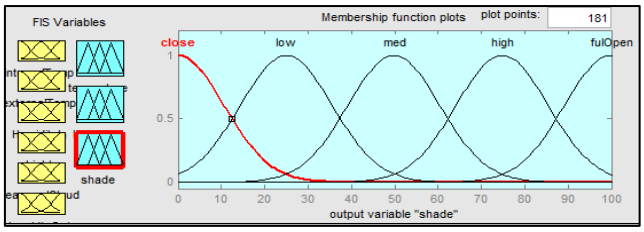

(c)

Fig. 9: Fuzzy outputs (a) Temperature (b) Humidity (c) Shade

An arbitrary threshold might be used to separate "warm" from "hot", but this would result in a discontinuous change when the input value passes over that threshold. The way to make the states "fuzzy" is to allow them change gradually from one state to the next. The input temperature states can be defined using "membership functions" as in figure 9.

The measurement and control system of environment parameters in greenhouse based on wireless communication technology and fuzzy logic controllers has developed and has given satisfactory results over the experiment. Sensors were connected to the system, which was utilised in LabVIEW and fuzzy logic controllers has been worked satisfactory.

In addition, it can be used for monitoring and controlling of different parameters in greenhouse. The overall result and experimental module can be easy to use and analyse by the user.

VI. Future Scope

The other important parameters can be consider for supervisory control through which is non-linearized such as Ph. Values, plant nutrition's, fertility of soil, ambient conditions, etc. A system can also be to develop to monitor and control from mobile places.

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