Review: Design Dynamically Fuzzy Logic Controller for Green House System using Labview

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Abstract— Tomato Crop Greenhouse climate control is the most important concern in the domain of agriculture in chhattisgarh. By monitoring soil moisture, temperature and relative humidity and by taking into consideration the other parameters like plant root depth, soil texture and water storage capacity of soil, plant water use capabilities one can make good harvest of tomato and also in achieving high yield. The work presented here brings out the potential advantages of applying FLC technique for Greenhouse climate control which included Irrigation These parameters play a vital role in the proper growth of crops. Here the constant temperature is maintained frequently by turning ON & OFF the light & fan. Temperature and soil moisture is controlled using arduino board and graphical user interface monitored and controlled using LabView. The purpose of this work is to design a labour free, sensor based greenhouse monitoring & controlling system which is fully automated. The output signal is generated from different sensors, which in turn sent to the for appropriate action. This results in proper growth of different plants in greenhouse. an automated environmental control system for a prototype greenhouse system using embedded systems technology. Efficiency and performance of AEC algorithm technique and the results of these has compared to one of the existing technique. he simulation result provides an exact idea for temperature, humidity, and water output for the prescribed agricultural field. The advantages of applying FLC are increasing Irrigation Efficiency, increasing the type of crop and harvest, in addition saving the electrical power. In this method the greenhouse effect using growth of different crops depend upon environment and crops growth condition. All condition set automatic using fuzzy logic all sensors are connected to arduino board and sensor value and analysis using labview and automatically take decision using fuzzy logic to control the greenhouse effect to help growth of crops and controlling fan, light and water using set of rule in fuzzy logic input of temperature humidity and soil moisture condition.

Keywords: Labview, Arduino, LIFA Tools, Fuzzy Logic Tool

I. INTRODUCTION

Tomatoes are one of the basic food crops of vegetables when most people in the world. Tomatoes growing well in warm fertile land exchange good advertising in areas exposed to direct sunlight for at least 6 hours a day. Tomato crop of choice for agriculture gardening is standard because it can grow in almost all types of land rows, plus it gives a great crop of relatively small area. Most varieties produce from 4.5 to 7 kg of fruit per leaf. Although they contain a high percentage of water has high nutritional value. as a source of energy, where many vegetables and other food crops got high benefits due to its contents of salts and vitamins and organic acids. Substantial the importance of this crop yields per unit area is still small compared to what it should have been due mainly to lack of correct methods in the cultivation of this yield. Many researchers use advanced technology in controlling environmental factors affecting mainly on the growth and the quality and quantity of agricultural crops, including tomato crop. The greenhouse is used, the weather conditions for the development of agricultural crops where work to control temperature and humidity and other environmental factors are excellently to reflect its impact on Agricultural crops [1-3]. Intelligent control system that combine sensors and actuator nodes currently are considered as one of the most significant technology in the greenhouse climate control [4-5]. Intelligent control system based on Fuzzy logic controller has great advantages in terms of cost, flexibility, autonomy and robustness as it compared to classical control system [6]. Greenhouses are used to enhance the environment condition for crops; hence, the climate control of a greenhouse (GH) requires deploying of multi types of sensors and actuators [7]. Using automatic control will highly assist of reducing energy conservation, scalability, enhance productivity process and reduce human intervention [8-11]. The important environmental factors such as Temperature, Light intensity,CO2 concentration, etc., affect the growth of crops and its development. The greenhouse system is composed of heating system, lighting system, ventilation system and automatic sprinkling system [1].

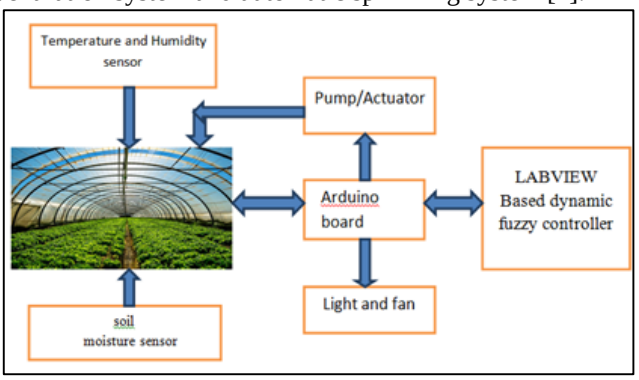

Fig. 1: Block diagram

This system is based on continuous monitoring and controlling the parameter which plays important role in green house. When the temperature reach a certain threshold value, the temperature sensor will send the information to controller, the controller will process that signal and perform appropriate actions. This system is designed in such a way that it automatically controls the different parameters such as temperature, intensity of light, soil moisture etc. This system reduces the manual overheads of monitoring different parameters and in process it reduces the percentage of the errors occurring due to the manual operations. Green houses are climate controlled. Green Houses have a variety of applications. The major application is being, off-season

growing of vegetables, fruit crop and plant breeding [5].The structure of greenhouse range in size from small sheds to industrial-sized buildings. A miniature greenhouse is called as a cold frame. The interior of a greenhouse exposed to sunlight becomes significantly warmer than the external ambient temperature and it protects its contents during cold weather. Many commercial glass greenhouses or hothouses provide high tech production facilities for vegetables and flowers. The glass greenhouses are equipped with screening installations, heating, cooling, and lighting. It may be controlled by a labview to optimize conditions for plant growth [5]. The environmental parameters temperature, moisture and smoke are sensed by sensors send signal arduino uno board and labview interface arduino though ni-visa send labview graphical user interface window and analysis the condition and send signal for output though arduino connected device.

A. Fuzzy Logic Control

Many practical control systems and processes have dynamic and complex characteristics, such as uncertainty and non-linearity. In addition, the complexity of such systems increases with the ever increasing demands for autonomy and intelligent decision making abilities. Accurate mathematical models to capture and model all these characteristics and attitudes are either not easily attainable or too complicated. The design of conventional controllers such as PID and the functionality and performance of these controllers depend on the accuracy of the models. Therefore, applying conventional controllers has revealed some limitations in controlling these systems particularly when they are applied to non-linear systems or when the circumstances surrounding a process under control are changing.

B. . Different types of tuning in fuzzy logic controller

1) Tuning via Trial and Error Methods

In most cases, a nominal fuzzy controller is designed for a plant and then, based on some prior knowledge, the controller parameters are adjusted by a process of trial and error until a satisfactory performance is achieved the adjustment might include the input and output membership functions' parameters, the input and output gains or the rule-base system.

2) Tuning via Intelligent Optimization Techniques

In order to deal with the difficulties in tuning fuzzy logic controllers and find optimal values of the parameters, the use of several intelligent optimization tools has been proposed by many researchers. These tools, also known as Evolutionary Algorithms (EAs), are inspired by the functionality of intelligent biological systems, either in the way they perform a task or how they find an optimal solution to a problem.

3) Tuning via Supervisory Algorithms

These algorithms are mainly based on the observation of some of the control system signals, such as the error, the change of error, the control signal, the plant output or (a combination of them) to adjust the controller parameters. In this scheme, an upper level algorithm or a fuzzy controller acting as a system supervisor, normally called a 'supervisor controller', is added to a system to monitor the performance of another direct fuzzy controller.

4) Tuning Methods from Conventional Control Algorithms

As fuzzy logic control has its foundation in the conventional control, there are some similarities between them for example, under certain conditions .an FPID controller is equivalent to a PID controller. In both, the control output is obtained from a combination of the error, the change of error and the integral of error. The combination is linear in the case of the PID controller, while it is 'fuzzified' in the case of the FPID controller and the control strategy in the FPID controller is formulated in the form of linguistic terms.

II. LITERATURE SURVEY

Frédéric Lafont et al. proposed A model-free control strategy for an experimental greenhouse with an application to fault accommodation Agricultural greenhouses and regulating them via advanced controllers are challenging tasks since strong perturbations, like meteorological variations, have to be taken into account. This is why we are developing here a new model-free control approach and the corresponding "intelligent" controllers, where the need of a "good" model disappears. This setting, which has been introduced quite recently and is easy to implement, is already successful in many engineering domains successful model-free control strategy and its fault-tolerant capabilities will be further developed by taking advantage of technologically more advanced greenhouse systems. Let us find out here, among many other possibilities, a regulation of the CO2 rate. Further comparisons with various other feedback synthesis techniques should also be investigated. [1]

Dinesh Singh Rana et al. a proposed a Fuzzy Logic Based Control System for Fresh Water Aquaculture: A MATLAB based Simulation Approach fuzzy control is regarded as the most widely used application we find out of fuzzy logic. We study about Fuzzy logic is an innovative technology to design solutions for multi parameter and non-linear control problems. One of the greatest advantages of fuzzy control is that it uses human experience and process information obtained from operator rather than a mathematical model for the definition of a control strategy and delivers solutions faster than conventional control design techniques. The proposed work includes a use of Data acquisition system, an interfacing device for on line parameter acquisition and analysis, fuzzy logic controller (FLC) for inferring the stress factor. The implementing the FLC in the MATLAB with the help of fuzzy logic toolbox and MATLAB programming can be utilized to control the various stress factors on the fish. This manuscript getting considers only three input parameters dissolved oxygen, temperature and conductivity. Some more such as dissolved ammonia and carbon dioxide may be included in order to get better degree of accuracy. [2]

Shalini V N et. al. praposed a method Green House Monitoring and Controlling Using Programmable Logic Controller (PLC) and LABVIEW. This system is based on continuous monitoring and controlling the parameter which plays important role in green house. When the temperature reach a certain threshold value, the temperature sensor will send the information to controller, the controller will process that signal and perform appropriate actions. This system is designed in such a way that it automatically controls the

different parameters such as temperature, intensity of light, soil moisture etc. This paper we find out system reduces the manual overheads of monitoring different parameters and in process it reduces the percentage of the errors occurring due to the manual operations. Green houses are climate controlled. We know that Green Houses have a variety of applications.

The major application is being, off-season growing of vegetables, fruit crop and plant breeding .The structure of greenhouse range in size from small sheds to industrial-sized buildings. A miniature greenhouse is called as a cold frame. The interior of a greenhouse exposed to sunlight becomes significantly warmer than the external ambient temperature and it protects its contents during cold weather. Many commercial glass greenhouses or hothouses provide high tech production facilities. We study and find out design Greenhouse Environment monitor and controlling using PLC and smoke detection using LABVIEW and develop a prototype of greenhouse environment monitor and controlling using PLC and smoke detection using LABVIEW and Verify the effectiveness of this system through testing on real time demand. [3]

Christakis Papageorgiou et. al. proposed Environmental Control of a Greenhouse System Using NI Embedded Systems Technology This paper presents the application of an automated environmental control system for a prototype greenhouse system using embedded systems technology. The prototype greenhouse system was developed and instrumented with appropriate sensors to measure various environmental variables like the temperature, the light intensity, the soil moisture, the air humidity and CO2 concentration. These measurements are provided to the control algorithm which is implemented on a embedded system and manipulates various actuators like, a heating and cooling actuator, fans, lights, irrigation system, and louvers in order to achieve the desired set-points, as specified by the user through a Human-Machine Interface implemented in LabView software. Certain aspects of the greenhouse dynamics have been modeled in Matlab/Simulink using nonlinear differential equations and the simulation model has been validated against experimental data, showing good agreement between the simulation and the experimental data. The purpose of this paper we find out is to enhance research related to the accurate environmental control of greenhouse systems in order to minimize energy and water consumption and to aim to develop a robust platform for control system design, analysis, instrumentation and embedded systems.[4]

R. G. Snyder et. al. proposed a "Environmental control of greenhouse tomatoes," The authors discuss the various functionalities of a greenhouse such as light intensity control, heating control, cooling control, air circulation control and humidity control. Various active and passive actuation devices are presented in order to achieve the desired regulation effect. A brief discussion on closed-loop (feedback) control is given, detailing some requirements on sensing environmental variables and on control algorithm implementation. Interestingly, the authors present their analysis based on the application of a greenhouse automated system for the extreme Alaskan weather. They quote: ``By optimizing light, temperature and humidity, in conjunction with the proper fertilization, watering and selection of adapted varieties, an endless array of growing opportunities await the Alaska greenhouse gardener and commercial producer''. Moving towards the more moderate Mediterranean climate, the authors in [5]

N. Bibi-Triki, et. al. a proposed and study the report of "Modeling, characterization and analysis of the dynamic behavior of heat transfers through polyethylene and glass walls of greenhouses," The automation of a greenhouse implies the implementation of a closed-loop (feedback) control algorithm, from the simplest on/off strategies employing thermostats to the most advanced PID and gain-scheduled controllers requiring accurate sensor measurements and algorithm development on embedded systems. The advantage of the implementation of a more advanced control algorithm is the ability to account for optimal design and operation requirements, like minimum energy control and accurate regulation in the presence of external weather disturbances and uncertainty in modeling accurately the biological processes characterizing the growth of plants. The design of an advanced control algorithm requires a good knowledge of the open-loop system dynamics, in our case, the greenhouse system. The process of acquiring knowledge and representing the open-loop dynamics of a system is called physical and mathematical modeling [6]

Didi Faouzi, et. al. submit report analysis Modeling and Simulation of Fuzzy Logic Controller for the purpose of Optimizing the Management Micro Climate of the Agricultural Greenhouseto related identified Agricultural greenhouse aims to create a favorable microclimate to the requirements of growth and development of culture, from the surrounding weather conditions, produce according to the cropping calendars fruits, vegetables and flower species out of season and widely available along the year. It is defined by its structural and functional architecture, the quality thermal, mechanical and optical of its wall, with its sealing level and the technical and technological accompanying. The greenhouse is a very confined environment, where multiple components are exchanged between key stakeholders and the factors are light, temperature and relative humidity.[7]

Asma Garrab et. al. proposed an method to An Agent Based Fuzzy Control for Smart Home Energy Management in Smart Grid Environment .Electrical Energy management in Smart Home environment is one of the main topics adopted in Smart Grid research field. In this paper, we find out a Multi-Agent System (MAS) for a Smart Home intelligent control. Such a solution was integrated in a smart meter in order to alter the shape of the residential load curve. The direct load control is based on Fuzzy Logic Control (FLC) using new fuzzy power indicator. In order to successfully implement our solution, customer acceptance of the direct load control is vital. We aim to reach a compromise among habitant comfort and electric bills in addition of satisfying technological constraints of appliances. Simulation results have proved the effectiveness of the proposed solution in energy savings. [8]

Roop Pahuja et.al. proposed a Design and Implementation of Fuzzy Temperature Control System for WSN Applications focus on application specific deployment and information processing in WSN. We find out general the design and implementation of rule based, simple, robust

closed loop temperature control system using Virtual Instrumentation (VI) technology. The controller software is designed to provide optimized output to drive a heating and cooling actuator network. The self-developed software (application program) with GUI, running on host PC, integrates and controls the operation of the hardware components to provide continuous temperature monitoring and control along with execution of add-on intelligent features. [9]

A. Hilali et.al. proposed a Control Based On the Temperature and Moisture, Using the Fuzzy Logic. design and implementation of an electronic system based on a for remote control of several experimental greenhouses. This system enables its user to consult the climatic parameters and to order the greenhouses sub-systems equipment's by SMS. The climate Sensors are packaged using the electronic circuits and the whole is being interfaced with maps of acquisitions (Arduino) via a radio frequency connection. These sensors provide information used for the control of ventilation, heating and water pumping by SMS. The acquisitions boards contain fuzzy controllers who manage the climate for local agricultural greenhouses. The procedure used in our system offers the operator an optimal control and monitoring without traveling to the place where the greenhouses are located, using his mobile phone, and being able to view at any moment the state of the greenhouse climate via the send and receive SMS function.[10]

Li Zheng et.al. proposed a practical method for tuning a PI like fuzzy controller. He proposed easier and faster tuning techniques and he employed triangular memberships function for fuzzification. He also reported a practical computer-aided tuning technique for fuzzy control. Triangular membership functions and center of gravity technique employed for fuzzification and defuzzification respectively [11,12].

T. H. Lee et al. reported position control for wheeled mobile robots using fuzzy logic controller, the FLC employed triangular member ship function for fuzzification and center of gravity technique for defuzzification[13], Mohamadien and Stonier developed a method to tune and optimize the membership functions of the FLC by using genetic algorithms [14].

Tetsuji Tani et al. illustrated a practical method of control using PID and fuzzy control for the top temperature of a petrochemical plant. They used triangular membership function for fuzzification [15].

Zazo et al. reported direct fuzzy control applied to a level process. They used triangular membership functions and COG defuzzification method, to get accurate output for any set point for a SISO nonlinear level process by fuzzy logic technique [16].

III. Problem Identification

Agricultural greenhouse is largely answered in the agricultural sphere to produce same vegetable fruit to all weather condition and climate change, despite the shortcomings it has, including overheating during the day and night cooling which sometimes results in the thermal inversion mainly due to its low inertia. The glasshouse dressed chapel is relatively more efficient than the conventional tunnel greenhouse. Its proliferation on the ground is more or less timid because of its relatively high cost Agricultural greenhouse aims to create a favorable microclimate to the requirements of growth and development of culture, from the surrounding weather conditions, produce according to the cropping calendars fruits, vegetables and flower species out of season and widely available along the year. It is defined by its structural and functional architecture, the quality thermal, mechanical and optical of its wall, with its sealing level and the technical and technological accompanying. There are so many technology to maintain the greenhouse condition to facing to same problem:-

The model of the system was implemented using MATLAB-Simulink tool-box for the analysis of thermal behavior of greenhouse. It is fast to implement and allows for the verification of installation of adequate and efficient systems. Secondly the performance FLC was evaluated and has shown good control over output. To improve behavior of such FLC it is necessary to use some optimization methods like Genetic Algorithm.[2]

The objective of offer to farmers a control system for greenhouses that will be automatically performing remotely via GSM, which can meet their needs.

The system is controlled by a master that is currently a privileged tool for data acquisition. This system has multiple benefits, namely the power of execution, the availability of Interfaces of control and monitoring, and also the level of data storage capacity.

IV. Expected Result & Discussion

The proposed method the main results of experimental measurements of climatic parameters (temperature, relative humidity of the air ...) performed in the experimental greenhouse. The aim is to maintain the air temperature in the range and the relative humidity air in the rang shown in fig.(6). The choice of the temperature and humidity range depends on the climatic requirements of the plants. The climatic parameters are measured and stored the data were recorded with no operation of fan and heater. temperature. The results show that the external temperature curve follows the same variation as of the internal temperature. Furthermore, the internal temperature values, appeared during the day and night, remain too high due to the greenhouse effect. The measurements obtained have allowed us to have a database of information on inputs, outputs and process disturbances

V. Conclusion

A greenhouse temperature and humidity control algorithm based on direct Fuzzy logic controller were designed, tested and implemented. Several actuators and sensors are installed and connected to an acquisition and control system based on personal computer and a data acquisition card. The overall tests indicated that the fuzzy controller worked satisfactory but at the expense of actuators frequent activity. This research has successfully showed that LabVIEW and Fuzzy Logic controller can be applied to develop a system for monitoring climate parameters under greenhouse. Using a computer system can cause some difficulties for the producer inexperienced with computers. But the developed system has

advantages that the designed program is user-friendly and the results could be easy to analyze by the user, as the front panel is a graphical user interface. The use of fuzzy logic requires however, the knowledge of a human expert to create an algorithm that mimics his/her expertise and thinking.

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