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Smart Green House Automation using LabVIEW and myRio

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Abstract

The integration of automated technology into agriculture records rapid development through the development of smart greenhouse systems. This project presents the design and implementation of an intelligent greenhouse automation system with LabView and Myrio, improving agricultural productivity by creating a controlled environment that adapts to real-time conditions. The system uses a variety of sensors to monitor environmental factors such as temperature, humidity. These parameters are collected and processed continuously by Myrio hardware, a compact embedded system that provides powerful real-time control. LabView, a graphics programming platform, is used to develop interfaces for systems. This allows for seamless visualization and control of greenhouse conditions. The system automatically adjusts environmental controls such as ventilation and irrigation to maintain optimal plant growth conditions. Additionally, the platform allows remote monitoring and manual intervention when needed, ensuring maximum efficiency and resource protection. This article examines the possibilities of this intelligent greenhouse system to promote sustainable agricultural practices and improve yields, simultaneously reducing operational costs. The proposed system demonstrates the practical application of advanced control techniques in agricultural automation and agrees with the goals of precision breeding and intellectual agriculture.

Keywords: Myrio, LabVIEW, Greenhouse, DHT22, Exhaust Fan, NI USB-1900.

1. Introduction

In recent years, the agriculture sector has faced many challenges, including climate change, resource shortages and the need to feed the ever-growing world population. As a result, there was a growing demand for innovative solutions that optimize agricultural practices and increase productivity. One of the most promising advances is the automation of greenhouse environments. This allows you to accurately control variables such as temperature, humidity. This can dramatically improve yield, reduce resource consumption, and increase operational efficiency plant. While traditional greenhouses are effective, they often rely on manual processes or simple automated systems that may not provide flexibility and real-time response for optimal system growth. The development of a more sophisticated smart greenhouse system that integrates sensors, real-time data processing and automated control allows for dynamic adjustments to environmental conditions based on system requirements. Grow house - Totalization System with LabVIEW and Myrio (National Instruments - Hardware Platform). LabView, a graphics programming environment, enables intuitive and powerful system designs, while Myrio provides a flexible and powerful platform for real-time control. The integration of these technologies makes it easier to monitor and regulate greenhouse conditions, ensuring and maximizing resource efficiency. Additionally, users with remote monitoring can pursue greenhouse conditions in real time and can examine the potential benefits of this smart greenhouse automation system to quickly recognize and correct problems. Reducing operational costs and improving plant quality in the further development of sustainable agriculture. The use of modern technologies such as LabVIEW and Myrio agrees with the purpose of precision breeding and intellectual agriculture, contributing to the future of sustainable food production.

2. Materials and Experimental Structure

2.1. Material for Greenhouse Casing

The experimental study on "Effect of deep tillage on soil physical properties in rice wheat cropping system" was planned and conducted during Rabi (winter season) of the year 2022-23. The materials and methods used for the study have been presented in this paper under the following sub headings:

1. General description of the experimental site
2. Treatment details of the experiment
3. Soil physical properties

2.1. General description of the experimental site

2.1.1 Climate and rainfall

Traditionally, greenhouses are constructed using glass, but this material has several disadvantages. Glass is heavy, requiring a strong supporting frame and deep foundations to bear its weight. It is also fragile and prone to breakage, which increases maintenance and replacement costs.

Additionally, the initial cost of building a glass greenhouse is high, making it a less economical choice. To overcome these limitations, acrylic sheets were selected for the prototype's greenhouse casing. This section explains the reasons for choosing acrylic over glass and the key considerations in material selection.

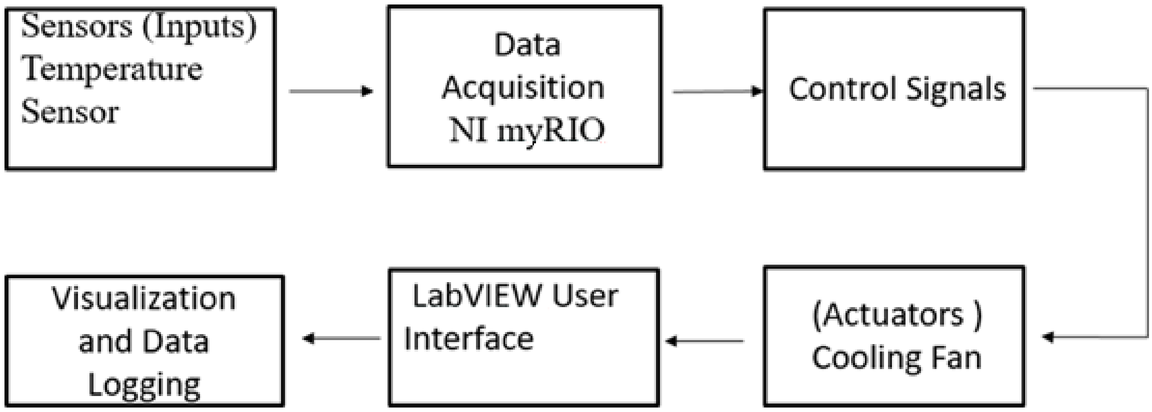

Figure.1. Block Diagram

Acrylic sheeting offers numerous advantages that make it a suitable alternative to glass. It provides exceptional clarity, comparable to high-quality optical glass, while being significantly lighter, reducing the structural load. Its durability is another major benefit, as acrylic has an impact resistance 6 to 17 times greater than glass, making it far less likely to break. Moreover, acrylic withstands various weather conditions and possesses excellent UV stability, preventing yellowing and maintaining its transparency for 15 to 20 years. It also contributes to energy efficiency by helping regulate internal temperature, reducing the need for artificial heating, which in turn lowers electricity consumption. Additionally, acrylic is resistant to many chemicals, enhancing its longevity. Another advantage is its ease of handling and fabrication. Thin acrylic sheets can be cut using a knife or scriber, similar to glass, whereas thicker sheets require a jigsaw with specialized acrylic blades. Given these benefits, acrylic was chosen as the casing material for the greenhouse. The dimensions of the casing are 19 inches in length, 12 inches in width, and 12 inches in height.

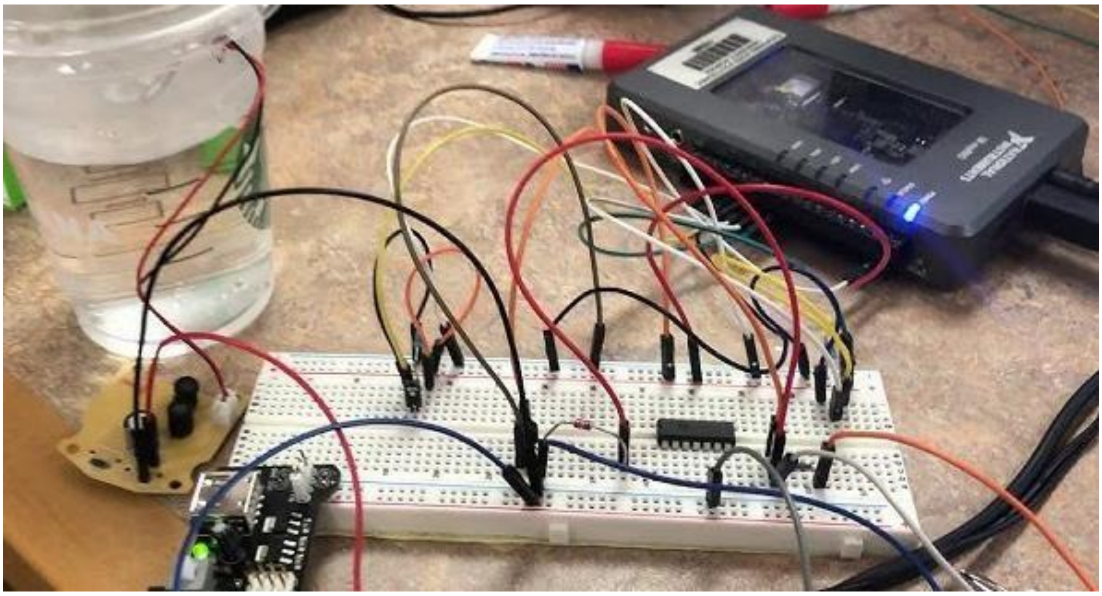

Figure.2. Hardware connection diagram

Table.1. Summary Table

Authors	Title	Year	Summary
Marya Erazo David Rivas Milton Pere Monica Huerta Jose Luix Rojo.[1]	Design and Implementation of a wireless sensor network for rose greenhouses monitoring.	2015	The study presents a wireless sensor network using the ZigBee communication standard to monitor watering, climate control, and lighting in rose greenhouses. This low-cost, remote supervision system aims to provide continuous monitoring capabilities to farmers in small and medium-sized enterprises within the flower-growing sector.
Fares M.A. Taha, Abdulla A Osman, Sally Dafallah Awadalkareem , Mysoon S.A.Omer, Razan S.M. Saadakdeen[2]	A design of a remote greenhouse monitoring , controlling system based on Internet of Things.	2018	The paper presents a remote greenhouse monitoring and control system utilizing Internet of Things (IoT) technology. It collects environmental parameters such as temperature, humidity, and light intensity, transmitting data to a Raspberry Pi server in real-time for efficient management.

YanYan, Anselme Herman Eyeleko, Adnan Mahmood, Jing Li, Zhuoyue Dong & Fei Xu Vol. 10, Issue 2.[3]	Remote Access Green-house Automation Application Based on LabVIEW – Published in Balkan Journal of Electrical & Computer Engineering.	2019	The study presents a remote greenhouse automation system utilizing the NI MyRIO control card and LabVIEW graphical programming. It enables real-time monitoring and control of environmental parameters such as temperature, humidity, and lighting, enhancing plant growth conditions.
Chodisetti L. S.S. Pavan Kumar,Vellanki Pradyumna.[4] Published in: Dogo Rangsang Research Journal, Vol.9, Issue 1.[4]	Greenhouse Automation System Through Wireless Protocol Using LabVIEW.	2022	This paper integrates wireless sensor networks with LabVIEW software to monitor and control greenhouse environmental parameters. Utilizing ZigBee technology for data transmission, the system collects real- time data.
Fran Casino, Constantinos Patsakis,Agusti Solanas [5]	Developing a Wireless Real-Time Automated Home Approach Utilizing NI MyRIO Controller and LabVIEW Platform.	2019	The paper presents a wireless real- time home automation system using the NI MyRIO controller and LabVIEW platform. It enables remote monitoring and control of home appliances via Wi-Fi, integrating sensors for automation and security features.
Pradeep Kasale, Shekhar Kedar, Mrinal Kishore, Prof. Kanchan Maske, Vol.4 Issue.3 [6]	Android based Greenhouse Monitoring and Controlling System International Journal of Computer Science and Mobile Computing.	2019	The paper presents an Android-based greenhouse monitoring and control system that uses sensors to measure environmental parameters like temperature, humidity, and soil moisture. The data is transmitted to a mobile app via Bluetooth, allowing users to monitor and control greenhouse conditions remotely.
Sahu and S.G.Mazumdar [7]	Digitally greenhouse monitoring and controlling of system based on embedded system. International Journal of Scientific & Engineering Research.	2020	The paper "Digitally Greenhouse Monitoring and Controlling of System Based on Embedded System" presents a microcontroller-based solution for real-time monitoring and control of greenhouse parameters such as temperature, humidity, soil moisture, and sunlight.

M. Dinesh and P. Saravanan [8]	Fpga based real time monitoring system for agricultural field International Journal of Electronics and Computer Science Engineering.	2020	An FPGA-based real-time monitoring system for agricultural fields typically uses sensors to measure environmental parameters like temperature, humidity, and soil moisture. The FPGA processes data in real time, enabling efficient monitoring and automation of irrigation and climate control for improved crop yield.
Majid Rafiei and Wil M.P. van der Aalst [9]	An arduino based wsn to control and monitor the greenhouse parameter.	2021	This paper discusses the development of a wireless sensor network (WSN) utilizing Arduino technology to monitor and manage greenhouse environmental factors. The system measures parameters such as temperature, humidity, and soil moisture, transmitting data wirelessly to a central unit for real- time analysis and control, thereby optimizing conditions for plant growth.
Dr.K.Shanmukha Swamy[10]	IOT based Greenhouse Automation using ESP July 2016 Wi-Fi module Raspberry pi and AWS.	2023	The paper "IOT Based Greenhouse Automation using ESP Wi-Fi Module, Raspberry Pi, and AWS" presents a system that automates greenhouse environmental control by integrating ESP8266 Wi-Fi modules with a Raspberry Pi and Amazon Web Services (AWS). Sensors monitor parameters like temperature, soil moisture, humidity, sunlight, and CO_2 levels, transmitting data to Raspberry Pi.

3. Testing and Analysis

3.1. Temperature Control

Temperature control is a common application of intelligent green automation systems, especially when you want to save energy and maintain optimal comfort or operating conditions at the same time. Whether you manage HVAC systems in a building or not, accurate temperature control for efficient energy consumption is extremely important in temperature sensitive environments in industrial processes, and even in smart home automation. The target temperature range for the system is typically an ideal temperature range of 20°C to 25°C (loop opening control elements) Sensor: Choose a temperature sensor that can be connected to Myrio, such as a DHT22. This sets the temperature based on the sensor value.

3.2. Humidity Control

Moisture control in a variety of applications is extremely important, from maintaining a comfortable internal environment to ensuring optimal conditions for industrial processes (data centers, agricultural environments, clean rooms, etc.). As well as temperature control, moisture control can be achieved using sensors for moisture measurement, actuators for environmental control, and laboratory for system design and automation.

Determine the system specifications and the type of environment to be managed. For example, maintain an RH of 40% to 60% indoors.

Sensor: Select a moisture sensor (DHT22, Honeywell HIH-4000, SHT31, etc.) for accurate readings. Flaker: Removes moisture from the air.

HVAC System: In some cases, you can adjust the air humidity using your existing HVAC system.

4. Result and Discussion

The results of the experiment are attached in the section. The GUI developed in LabVIEW through which user can continuously monitor greenhouse parameters and responds as soon as the system is subjected to changes by doing appropriate action.

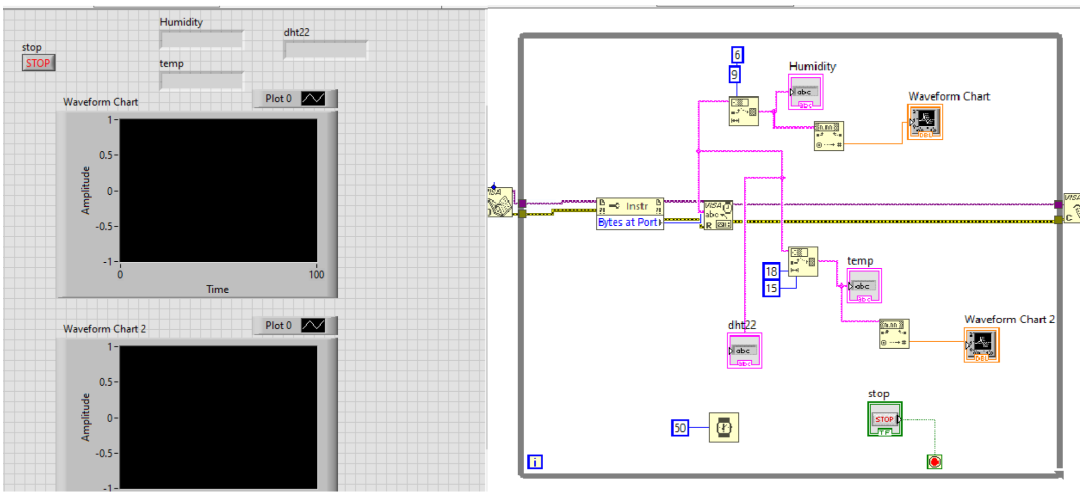

Figure.3. LabVIEW Connection Diagram

It can be observed that the use of monitoring and control Systems with the help of GUI allows to monitor key parameter for plant growth such as temperature, relative humidity, Soil moisture, Light intensity etc. The software and hardware used allow to know the, etc. Which makes it possible to perform simple control strategies.

5. Conclusion

In summary, the system can be said. Automating processes, recording and processing data, and managing real systems is especially effective. Integrated E/A features can be used to monitor and control sensors and actuators in real time. Smart Green Automation Systems, Die Efficient such as Energy management, optimization, and control are improved through real-time monitoring and intelligent decision-making. Sustainable, by integrating renewable energy sources and optimizing performance, these systems reduce energy consumption and minimize waste. Overall, this combination provides a strong foundation for creating state-ART solutions for smart energy automation, and sustainability. The growing demand for environmentally friendly technologies.

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