ISSN 2348 – 8034
Impact Factor- 3.155

GLOBAL JOURNAL OF ENGINEERING SCIENCE AND RESEARCHES

DEVELOPING A REAL-TIME SYSTEM USING LABVIEW FOR MONITORING AND CONTROLLING THE INSIDE TEMPERATURE-A GREENHOUSE AUTOMATION

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ABSTRACT

Greenhouses are productive systems characterized by an intensive but efficient use of primary resources. It is well known that CO_2 enrichment increases the photosynthesis rates in plants thus reducing environmental contamination. However, in countries with mild climates, the utilization of heating and CO_2 is reduced due to the cost of traditional systems, along with lower heating requirements. Developing a greenhouse remote monitoring system that does not require manual changes with each physical variations in atmospheric conditions. It monitors the system all through the day and maintains the local temperature inside the greenhouse at a constant. The objective of our project is to reduce manpower in the maintenance of greenhouse through automation and control of its parameters through artificial environment. This project is done using NI LabVIEW software. In case of any malfunctions in the setup intimation will be sent to the user for immediate response.

Keywords: *Greenhouse, LabVIEW, Automation, DAQ card .*

I. INTRODUCTION

In order to meet the increasing demands for high quality and safe vegetable products, it is critical to effectively manage the growth of vegetables, especially during the seedling stage. In the last two decades, the majority of the seedling growth has been moved into greenhouses, where the seedlings grow in regular trays under automatically controlled environments. Although the macro-environment in a greenhouse remains relatively constant, micro-environment around each tray could differ drastically. The outside factors such as cloudy and rainy weather are known to affect the micro-environment of the seedlings, but the inside factors such as the shade from the greenhouse architecture and the temperature gradients also play an important role. Moreover, uniform operation of automatic devices, e.g. the spraying system, is a key to providing the same irrigation to the different crops or to the different days of growth of the seedlings in the same greenhouse. Therefore, the development of a reliable and traceable system capable of sensing the whole environment while monitoring the factors critical to plant growth will be crucial to greenhouse operation.

II. GREENHOUSE AND AUTOMATION

Automation through LabVIEW

LabVIEW software is developed by National Instruments. By using the sensors (temperature, humidity, CO_2 sensors, etc.) connected to a computer, the corresponding variations can be controlled accordingly to maintain the normal growth of the plants inside the greenhouse.

DAQ card

The DAQ used is NI USB-6009. The NI USB-6009 provides connection to eight single-ended analog input (AI) channels, two analog output (AO) channels, 12 digital input/output (DIO) channels, and a 32-bit counter with a full-speed USB interface. It has 8 analog inputs (14-bit, 48 kS/s) and 2 analog outputs (12-bit, 150 S/s), 12 digital I/O, 32-bit counter. Bus-powered for high mobility and has built-in signal connectivity.OEM version is available. It is compatible with LabVIEW, LabWindows™/CVI, and Measurement Studio for Visual Studio.NET.

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Figure: ***NI USB-6009***

Greenhouse

Our greenhouse is a miniature model house which is 1.5×1×1 (l×b×h) meter in dimensions made of steel frame. It is covered by a thick polythene sheet around it so that it traps only a small amount of heat from the environment. This polythene sheet makes the greenhouse cooler. Two exhaust fans and a water tank with pipes are placed inside the greenhouse to obtain an optimum temperature.

Figure

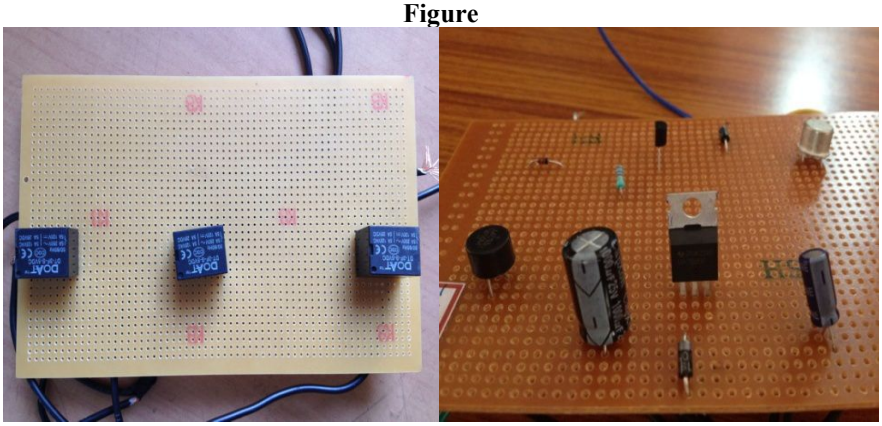
Greenhouse Structure

Components and their functions

Two exhaust fans are placed inside the green house, one is used for exhaust the hot air from the greenhouse and the other is used for drawing the air from the environment. The chalk inside the wire mesh is placed before the exhaust fan which is drawing the air for cooling the greenhouse for giving moderate conditions. The submersible pump is placed inside the tank which is also placed inside the greenhouse which is used for irrigation for growing plants and also for cooling the greenhouse. A slot for placing a solar panel is also made while constructing the structure. The exhaust fans and submersible pump are operated by using 5volts which is obtained from the DAQ 6009. The 5volt which is generated is connected to relay switch. The relay switch generates 220volts from the 5 volts generated by DAQ card.

ISSN 2348 – 8034
Impact Factor- 3.155

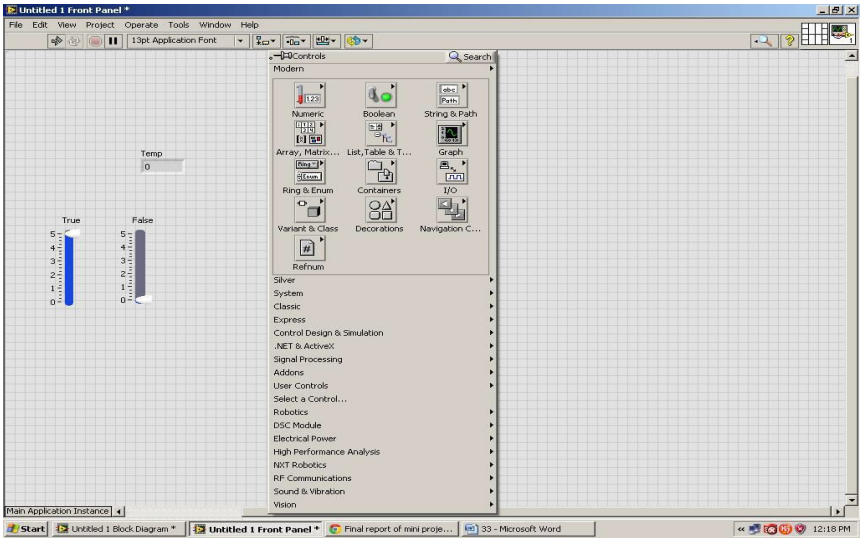
Figure



Relay Circuits *Rectifier Circuit*

Front Panel

The front panel is what allows the operator to control and monitor the process. It includes software controls and indicators that mimic physical controls such as buttons, sliders, LEDs, and charts.

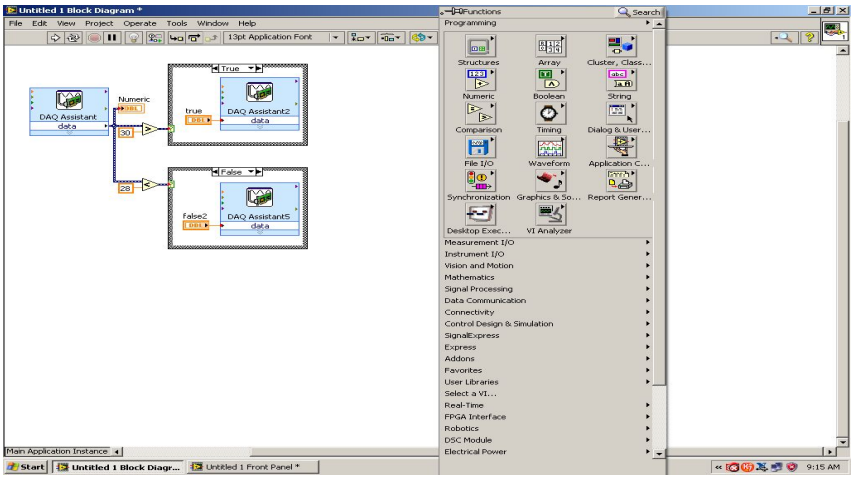


Front Panel of LabVIEW

III. PROCESS

The process involves various steps in which the temperature is sensed by the thermocouple through the DAQ card. The obtained temperature is compared with the temperature limiting conditions. As the temperature reaches the higher limit, an output of 5 volt is generated at the end of DAQ. Then the 5 volt is supplied to the relay circuit (as shown in figure below) which is further connected to the exhaust fan in the NO port of relay switch. In the next case, when the temperature obtained if it is less than that the limited value, then 0 volts is generated from the output terminal. Thus no voltage passes through the relay and thus the connection switch changes from NO to NC. Thus the fan is switched off. If the temperature changes periodically, the conditions which is described above occurs automatically. A separate relay is used for the purpose of water supply to the plants inside the greenhouse. The plants need water at regular intervals thus a timer is visually allowed to run in LabVIEW program. As the timer stops, the submersible pump is allowed to turn ON then after sometime the timer is switched OFF.

ISSN 2348 – 8034
Impact Factor- 3.155



Block Diagram of LabVIEW

IV. RESULT & DISCUSSION

The inside temperature is maintained by automation through LabVIEW. The operation is done for 10 minutes and the variations are measured and tabulated for the various operations like, only one fan operated, two fans are operated, and sprinkler are operated.

Table

Table 1. Monitoring inside temperature

	Measured (Degree Celsius)	Reduced (Degree Celsius)
Atm. Temperature	34.23	
Greenhouse Inside Temperature	35.36	
Using One Fan	33.02	2.34
Using both Fan	31.57	3.79

V. CONCLUSION

Thus our greenhouse is fully automated to maintain the inside temperature optimum for plants. The real time system which is implemented in this, when it is made to work for some period of time, then it is able to reduce the temperature to around 25 Degree Celsius. Thus the temperature required by several other plants can be identified and the inside temperature can be maintained accordingly and the water supply can be given to plants at proper time intervals for their healthy growth.

VI. ACKNOWLEDGEMENTS

At the outset we would like to thank god for having given us the mindset to complete this project successfully .We would like to express our gratitude to our Principal and Head of the Department, Dr. V.SELLADURAI M.E., Ph.D., for his support and encouragement in completing this project. We would not have natured our thoughts to complete this project with great success without the guidance of our mentor Mr. TONY PUNNOOSE VALAYIL, M.Tech. He ably guided us in teaching the concepts and made us to explain them during the course of the project. We are also

very much thankful to Dr. N. RAJAM RAMASAMY M.E., Ph.D., for providing the facilities at his Robotics and Mechatronics Laboratory. We are very grateful and thankful to him for the beckoned light on us in our life.

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