SOLUTION FOR TEMPERATURE MEASUREMENT USING DATA AQUISITION SYSTEM AND LABVIEW

Assist. PhD. Eng. **Constantin-Florin OCOLEANU**, Prof. PhD. Eng. **Gheorghe MANOLEA**
Electrical Engineering Faculty of Craiova

ABSTRACT. Lately there is a tendency to replace the meter with a self assembly modular, adaptable applications desired. Virtual Instrumentation (VI) environments become more specialized subject. One of the most widespread is LabVIEW, a programming environment based on graphical programming language G. Due to the possibility of instrumentation systems to be built to use, save time and can intervene quickly in the measurement or control system. This paper presents a solution for temperature measurement using a data acquisition system, digital thermometer and a graphical interface development in LabVIEW.

Key words: virtual instrumentation, data system aquisition, sensor.

REZUMAT. În ultima perioadă există tendinţa de înlocuire a aparatului de măsură autonom cu un ansamblu modular, adaptabil aplicațiilor dorite. Instrumentuaţia virtuală a devenit obiectul multor medii de lucru specializate. Unul dintre cele mai răspândite este LabVIEW, un mediu de programare bazat pe limbajul de programare grafică G. Datorită posibilităţii de a fi construite sisteme de instrumentaţie de utilizator, se câştigă timp şi se poate interveni rapid în cadrul sistemului de măsurare sau control. Lucrarea de față prezintă o soluție pentru măsurarea temperaturii utilizând un sistem de achiziție de date, termometru digital și o interfață grafică realizată în LabVIEW.

Cuvinte cheie: instrumentație virtuală, sistem de achiziție de date, senzor.

1. INTRODUCTION

Lately there is a tendency to replace the meter with a self assembly modular, adaptable applications desired [6].

Virtual Instrumentation (VI) environments become more specialized subject. One of the most widespread is LabVIEW, a programming environment based on graphical programming language G.

Due to the possibility of instrumentation systems to be built to use, save time and can intervene quickly in the measurement or control system.

LabVIEW is a graphical development environment that makes scientists and engineers more productive [10].

The concept of virtual instrumentation is, an engineer can use software running on a computer combined with instrumentation hardware to define a custom, built-to-order test and measurement solution [2].

The vision of virtual instrumentation revolutionized the way engineers and scientists work, delivering solutions with faster development time, lower costs, and greater flexibility.

In specialized literature are presented many solutions for temperature measurement using LabVIEW [3], [5], [4].

Temperature sensor can be a thermocuple, thermoresistance, digital temperature sensor, wireless sensor depending the required applications and the aquisition data system input.

This paper presents a solution for temperature measurement using a DLP-IO8 Data Acquisition Module, DS18B20 digital temperature sensors and LabVIEW Graphical Interface.

Graphical Interface was development in LabVIEW and offer the posibility to measure temperature, establishing a minimum threshold and signaling the exceeded temperature. There is also the option to save the data recorded into a file.

2. TEMPERATURE MEASUREMENT SYSTEM PRESENTATION

Temperature measurement system consist in three main parts:

DLP-IO8 Data Acquisition Module;
DS18B20 digital temperature sensors;
LabVIEW Graphical Interface.

A. DLP-IO8 Data Acquisition Module [9] is use for measuring voltages, controlling and monitoring processes, and acquiring temperature data. Each of the 8 available channels can be configured for any of the digital, analog, or temperature modes via single-byte commands. All operational power is taken from the host PC via the USB port (Fig.1).

Fig. 1. DLP-IO8 Data Acquisition Module.

The DLP-IO8 is a 5-volt system that derives its power from the host USB port.

B. DS18B20 digital temperature sensors [8] provides 9-bit to 12-bit Celsius temperature measurements (Fig.2). It has an operating temperature range of -55°C to +125°C and is accurate to ±0.5°C over the range of -10°C to +85°C. In addition, the DS18B20 can derive power directly from the data line, eliminating the need for an external power supply.

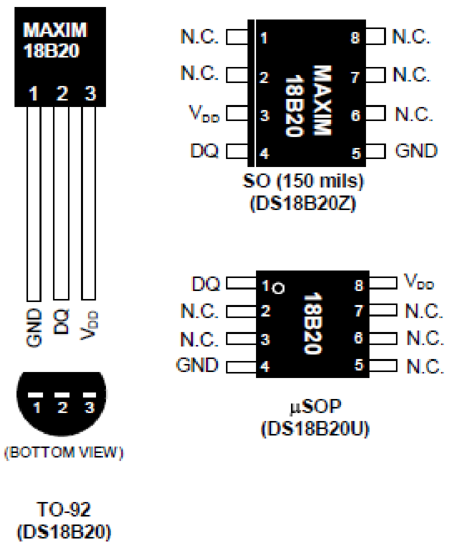

Fig. 2. DS18B20 digital temperature sensors.

Applications that can benefit from this feature includ temperature monitoring, process monitoring and control systems.

Temperature sensor schema connection at DLP-IO8 is presented in Figure 3.

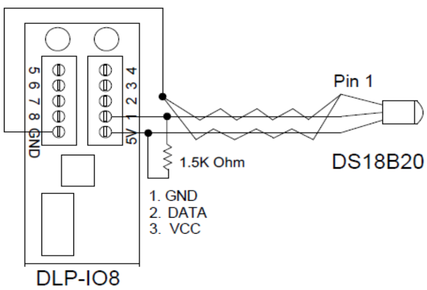

Fig. 3. Temperature sensor schema connection at DLP-IO8.

C. System graphical interface was developement in LabVIEW. Graphical interface allows the user to see temperature values, establishing a minimum threshold and signaling the exceeded temperature. There is also the option to save the data recorded in a file (eg file extension. xls in this case).

The Block Diagram coresponding to the created interface was created starting from a *while* loop. In the first step we create the posibility to write the DLP buffer and comunication port selection (fig. 4).

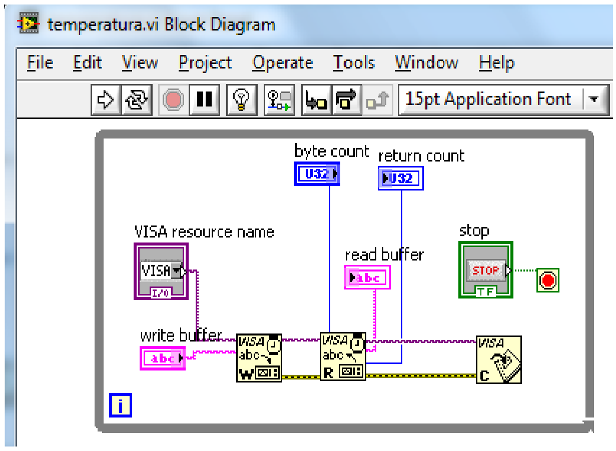

Fig. 4. Block Diagram created in first step.

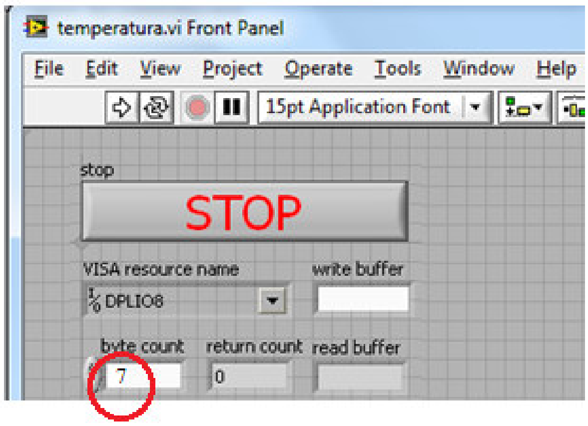

Fig. 5. Front Panel coresponding to Block Diagram.

LabVIEW default temperature display in fahrenheit. So we created a small program in LabVIEW to convert Fahrenheit in Celsius (fig.6) using relation (1).

$$(F - 32)*5/9 = C \qquad (1)$$

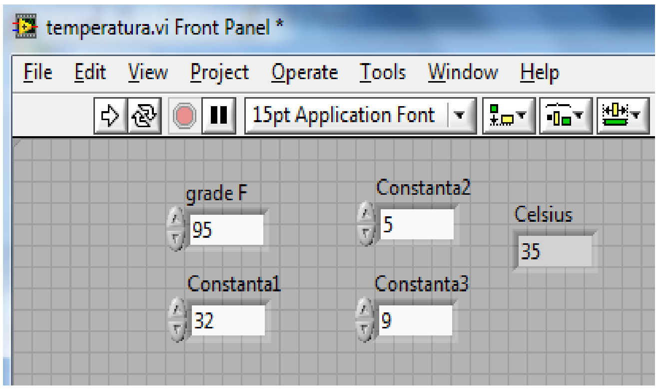

Fig. 6. Front Panel for converting temperature.

The Block Diagram coresponding to relation (1) is presented in figure (7).

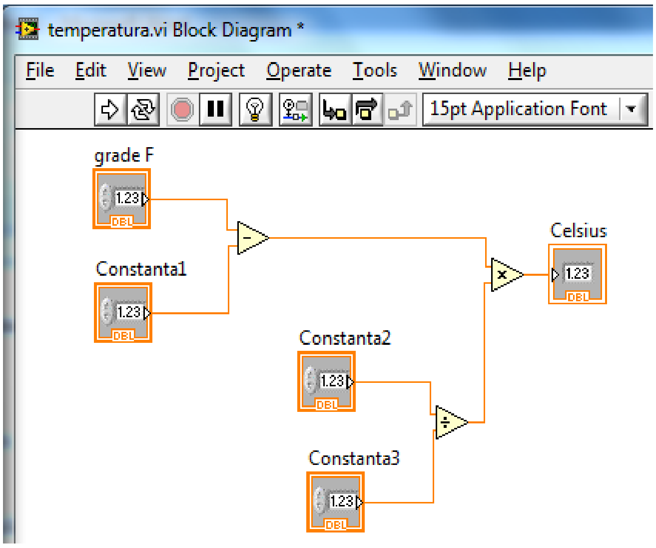

Fig. 7. Front Panel for converting temperature.

Next we chose to create a visual alarm that changes color when a threshold is exceeded (fig.8). Graphical interface was provided with the possibility of establishing a minimum threshold.

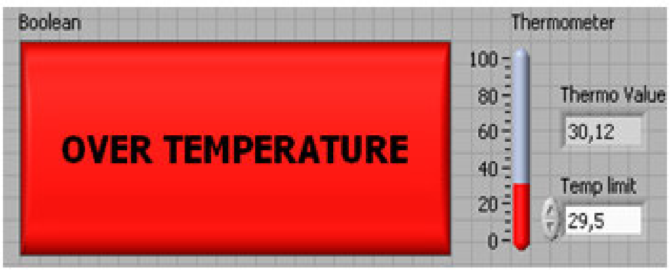

Fig. 8. Visual alarm for thresold exceeded.

We created the possibility of establishing a measurement time using a sequential structure and code status OR = Stop (fig. 9).

Time from 0 serves as a basic value and time value sequence will be TRUE since is the time structure. This will allow determining the time elapsed.

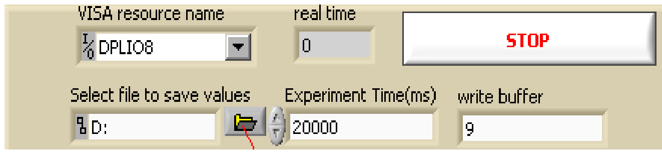

Fig. 9. Front Panel for time choosing.

Block Diagram and Front Panel coresponding to graphical interface are presented in figure 10 and 11.

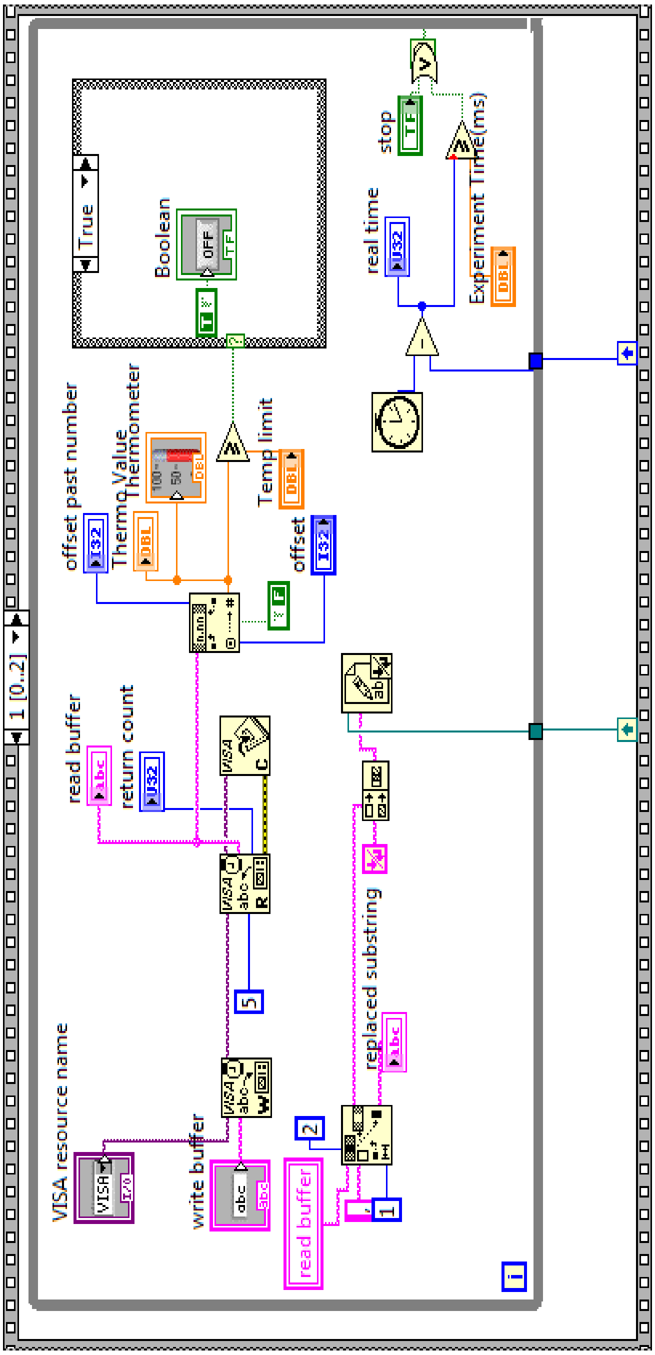

Fig. 10. Block Diagram coresponding to system temperature measurement.

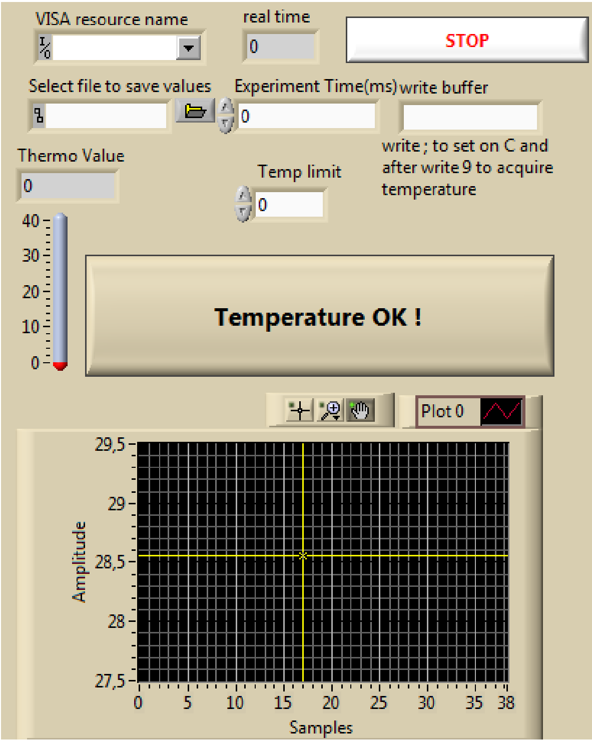

Fig. 11. Front Panel for graphical interface.

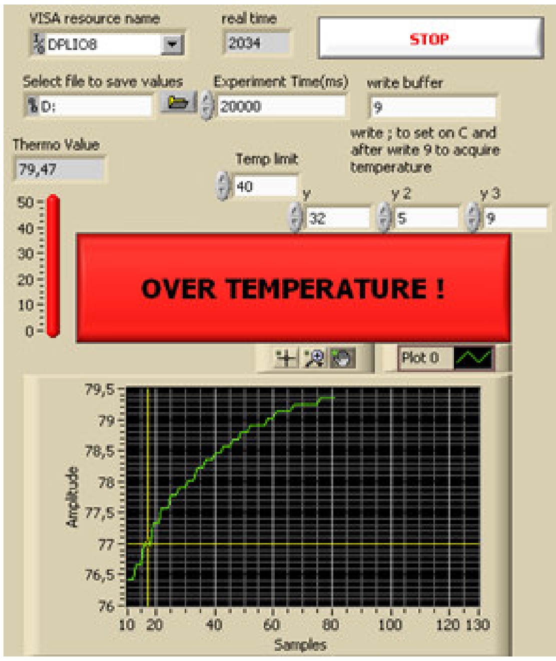

Fig. 13. Front Panel coresponding to system temperature measurement.

3. APPLICATIONS

For test the temperature system measurement working with graphical interface development in LabVIEW we had made an aquisition.

We measure temperature in bus bars during heating transient regime.

The first step is to establishing a minimum threshold for temperature. Then must be set the measurement time.

The next step, when running user interface, is to choose where the data will be saved (fig.12).

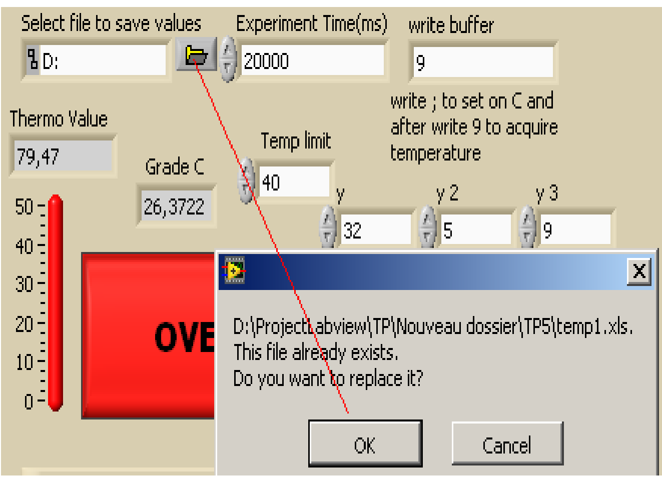

Fig. 12. Front Panel for choosing data save location.

For stoping the aquisition the user can utilise the Stop buton. The results are presented in figure 13.

4. CONCLUSION

Graphical Interface was development in LabVIEW and offer the posibility to measure temperature, establishing a minimum threshold and signaling the exceeded temperature. There is also the option to save the data recorded into a file.

Acquisition system presented with graphical interface developed in LabVIEW can be used successfully in various applications with temperature monitoring in addition to a low-cost advantages of ease use and friendly interface.

BIBLIOGRAPHY

[1] **Dolga V.,** *Instrumentație virtuală cu LabView,* Curs, Timişoara

[2] **Jayaram Pillai,** *Virtual Instrumentation - Changing the Face of Design*

[3] **Jing Sutong Zhao Futang,** *Thermocouple Temperature Measure System Based on LabVIEW*, Beijing

[4] **Josu A. D.,** *Wireless temperature measurement with LabVIEW*

[5] **PENG Bing-hua, PAN Sheng-hui,** *Temperature Test System Based on Virtual Instrument*, China

[6] **Ştefănescu C., Cupcea N.,** *Electronică aplicată - Sisteme inteligente hardware,* Curs, Bucureşti, 2003

[7] **Ocoleanu C.F.**, **Manolea Gh., POPA I.**, *Experimental validation of numerical results corresponding to catenary contact wire temperature*, Annals of University of Craiova, Electrical Engineering series, No. 35, 2011, pag. 152-157

[8] *** *http://datasheets.maxim-ic.com/en/ds/DS18B20.pdf*

[9] *** *http://www.dlpdesign.com*

[10] *** *www.ni.com/labview*