

WEATHER MONITORING SYSTEM WITH TRANSMITTER VAILASA WXT520

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ABSTRACT

This paper describes measuring system Transmitter Vaisala WXT520 for monitoring meteorological conditions. The measured weather condition parameters will be used for evaluation of a wind power plant with vertical rotation axis operation effectiveness. This meteorological station is connected to a measuring system based on National Instruments CompactRIO system.]

1. INTRODUCTION

The measurement system for the wind power plant with the vertical axis of rotation has been already developed at the Department of Electrical Power Engineering in last year. We can consider the measured values from the output of the plant to be a reliable; they must be compared with values obtained in the gauge set. To measure the valid values there was chosen the Vaisala transmitter WXT520 [1]. This converter has sufficient accuracy and reliability.

2. IMPLEMENTATION OF THE WXT520 TO THE MEASURING SYSTEM

The Transmitter WXT520 from Finnish company Vaisala enables data transmission using various types of interface. The most widespread and most commonly used there are RS232 and RS485. For measuring system at university department the RS232 is suitable because the used CompactRIO controller [2] has also a RS232 interface. There was just necessary to change the communication protocol of the WXT520 for communication via RS232.

2.1. TRANSMITTER WXT520

WXT520 is an ideal combination of several meteorological instruments. It allows measurement of the air pressure, relative humidity, air temperature, precipitation, wind speed and its direction. Therefore this is very compact device and easily portable. Among its other advantages include, for example:

- Low power consumption, the possibility of power from solar panels
- Accuracy and stability
- Compact and lightweight construction

- Easy and quick installation
- Lack of moving parts
- Configuration from the computer
- Possible connection via USB connector
- Increased coverage on IP66 with fitting kit

It makes the unit ideal for easy measurement and evaluation of weather condition and easy to use in process of a wind power plant construction planning.



Figure 1: Transmitter Vaisala WXT520 [1].

2.2. MEASURING SYSTEM COMPACTRIO

Measuring system NI CompactRIO [2] is suitable tool for the autonomous operation. This system sufficiently meets requirements for reliability and accuracy. This element provides communication between the transmitter WXT520 and databases where the measured values are stored. One of the significant advantages of the controller NI cRIO 9022 is the possibility of backup power.

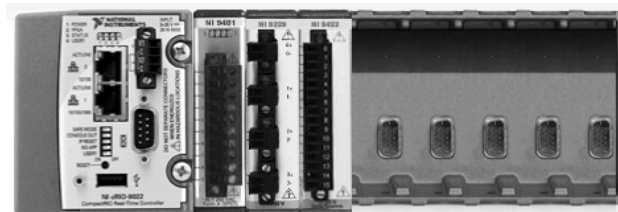


Figure 2: Ni cRIO 9022 [2].

2.3. MEASURING CARDS

Measuring system is fitted with measuring cards.

- NI 9422 – Impulses counter – used to measure rotation speed of power plant [3]
- NI 9229 – Analog inputs – used to measure battery and generator voltage [4]
- NI 9481 – Relay card – used to braking control and resistance contactor [5]

Using these measuring cards and WXT520 there are scanned following variables:

- battery current and voltage
- generator voltage

- generator rotation speed
- wind speed and its direction

2.4. NI LABVIEW

The graphical programming language LabVIEW (Virtual Instruments Laboratory Engineering Workbench) or “virtual laboratory work equipment” is a product of the American company National Instruments. This company is the most important pioneer and largest manufacturer in the field of virtual instrumentation, which is experiencing a great expansion in the field of development and research, education and industry. LabVIEW is suitable not only for programming systems for measurement and signal analysis, management and visualization of technological processes, but also for the programming of complex systems. With some exaggeration it is possible to say that LabVIEW does not have limit in applicability.

2.5. COMMUNICATION BETWEEN WXT520 AND LABVIEW

The measuring program supports continual recording meteorological dates. The program has to operate in the loop until the program will be manually switched off.

The serial port is a system tool. To be able to work with it, there is necessary to reserve it for our application.

There is shown the configuration of the serial port for our application in the Figure 3. The block VISA Open performs for communication with serial port. For configuration of the serial port is the biggest block “instr” in Figure 3. It has a few parameters which is able to be set up.

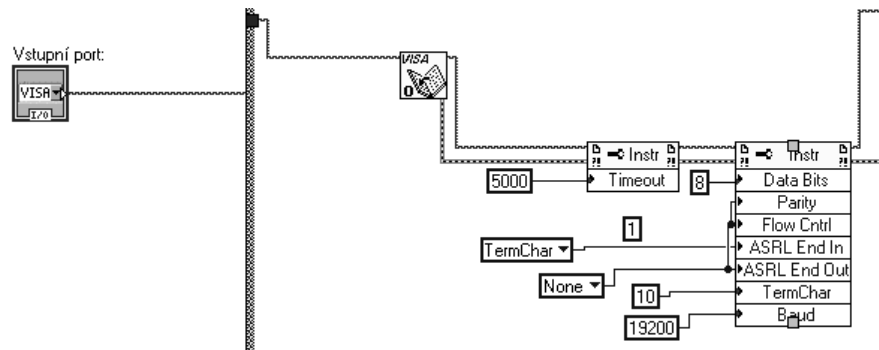


Figure 3: Configuration of the RS232 interface in LV.

2.6. PREVIEW TO THE WHOLE MEASURING SYSTEM

Measuring system is shown to block in Figure 4. All these measured variables processing Ni cRIO 9022 [2]. Processed data migrating to the database and the last stage is the web interface, where the possibility of access to the measured values.

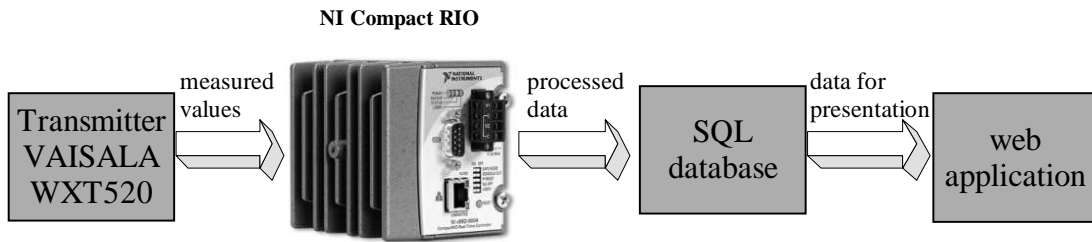


Figure 4: Measuring system.

These measured data will further process and stored in the SQL database, where they will be available for possible further processing.

2.7. DATA PROCESSING

Recording and storing dates is the first period of the processing of the values. In the second period the dates will be present on the web pages of Department of Electrical Power Engineering. The second period is in the planning stage.

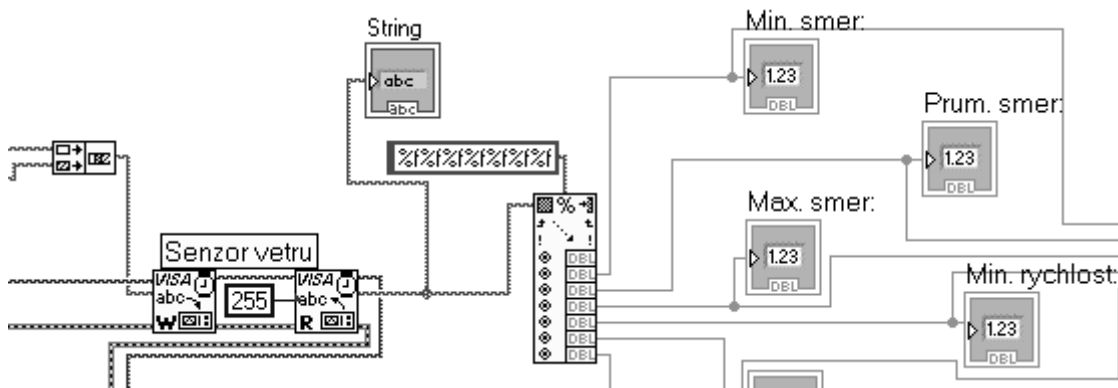


Figure 5: Part of the source program for data processing

In the figure 5 is shown example of the program source code for the dates processing. The block “VISA Write” and “VISA Read” reads the dates from the transmitter. The block “Scan from String” supports right formatting of the numbers. These numbers are visualized in the front panel in the figure 6.

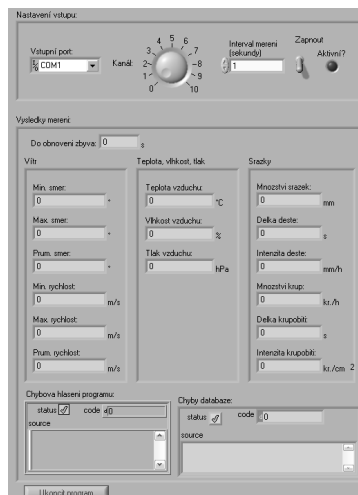


Figure 6: The interface of the program

The aggregation of the dates is in the progress right now. Given the variability of measured values with the time intervals between the download loops has to be appropriately selected. Interval will be in the orders of unit minute. Sample of the measured data by WXT520 converter shows Table 1.

time	air temperature	air humidity	air pressure	wind direction	wind speed
2010-03-24 11:35:01	26.2	25.4	984	295	0.2
2010-03-24 11:38:06	26.2	25.8	983.9	123	0.1
2010-03-24 11:38:17	26.2	25.8	983.9	217	0.2
2010-03-24 11:38:28	26.2	25.9	983.9	118	0.1
2010-03-24 11:38:40	26.2	26	983.9	221	0.2
2010-03-24 11:38:51	26.2	25.7	983.9	201	0.7
2010-03-24 11:39:02	26.2	28.3	984	304	2.7
2010-03-24 11:39:13	26.2	29.3	984	331	2.4
2010-03-24 11:39:24	26.2	30.5	984	58	2.3
2010-03-24 11:39:35	26.2	28.7	984	10	2.5
2010-03-24 11:39:47	26.2	27.7	984	75	3.1
2010-03-24 11:39:58	26.2	27.3	984	108	0.2
2010-03-25 15:16:59	24.1	33.3	977.2	97	0.2
2010-03-25 15:17:10	24.1	33.3	977.3	113	0.2
2010-03-25 15:17:21	24.1	33.3	977.3	63	0.2
2010-03-25 15:17:33	24.1	33.3	977.3	68	0.2

Table 1: Listing of the sample values from the database

3. CONCLUSION

The measuring system of wind power plant with the vertical rotation axis ensures maximum safety and reliability of operation. Among other things, it can measure wind speed and its direction, atmospheric pressure and temperature. In the chapter 2.6 there is described how the measuring system will be look like even with a web presentation. Measuring system is a complicated and there is a much work which has to be done.

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