

## Mobile Application for Measured Data Processing using A/D Converter AD4ETH

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**Abstract**-The aim of this work is to create application for mobile devices such as PDAs running under Windows Mobile. With this application, and PDA it will be able to process the analog data measured by the A / D converter and display it in graphs. Use of the converter has four analog inputs. These are converted into digital form and transmitted via the communication interface Ethernet to WiFi router. Application running on a PDA uses WiFi connection to download measured data and to processes them. The advantage of this solution is particularly small size and mobility of the PDA. This eliminates the need to transfer the measuring device. This makes a possibility of usage wide especially in the manufacturing industry in the halls where it should be measured in several places at the same time, and the values compared between each other.

**Keywords**- PDA; A/D converter; WiFi; Ethernet; AD4ETH

### 1. Introduction

In industry and in industrial areas during the production process it is often a needed to monitor - to measure variables such as temperature, humidity, fluid conductivity, etc. This can be done by the sensors, which measure value converted to electric. voltage and current. These values can be then processed by measuring devices, or displayed in the graphs.

To measure it is possible to use ready-measuring devices that are intended for that. It is a specific device designed to measure specific variables such as thermometers, pressure gauge, voltmeter, etc. The advantage of these devices is fast and simple operation. The problem arises when it is necessary to measure simultaneously multiple variables and compare them with each other in real time. For this device which allows to measure the required quantities and to display in one output. On the market there has been a measuring device which allows measurement of multiple inputs, but only a particular variable [1]. Which still does not solve the problem.

They might need to measure the temperature of the dampening solution in the tank for the offset printing machine, where it is necessary to measure the conductivity of the liquid in the tank. To do this we need a thermometer and a device to measure the conductivity, this makes two measuring devices. And if it was needed to measure simultaneously on the second printing machine, the next two devices would be needed. That together makes us have four devices, which represents an additional cost of purchasing the measuring technique.

The solution offered in the use of universal A/D converter, i.e. from the company Papouch Ltd. ([www.papouch.com](http://www.papouch.com)), which offers a variety of transmitters communicating via RS232/RS485, USB or Ethernet. For declared usage AD4ETH converter was chosen. AD4ETH is a four inputs A / D converter, which measures four currents or voltages. Inputs are ready for unified range 0-10V or 0 (4)-20mA (other ranges on request). With web pages, SNMP, and other communication options [2]. The input of this

transmitter can be connected to sensors for measuring temperature and conductivity. Analog values thus obtained converter processes and writes into an XML file. Over Ethernet data are transmitted into the WiFi router from where any device equipped by WiFi receiver can download them (laptop, PDA, cell phone). AD4ETH can send in a regular interval measured data as HTTP POST in form of XML SOAP (Simple Object Access Protocol). This method is ideal for further processing of measured values by Web services (Web Service) waiting for on a server on the Internet or corporate network. These data in XML format can be easily processed in such environments as .NET - no need to deal with the programming protocol, etc. You need just to process the supplied XML file. [2]

Today's PDAs are able to communicate with both Bluetooth and WiFi. In addition, a device is small, light and portable. Therefore, the solution we like the best is PDA.

Then you need to create an application that is executable on the PDA under Windows Mobile. Windows Mobile is operating system by Microsoft, which is based on Windows CE. It is designed for mobile devices (PDAs, Smartphones and Portable Media Center). It uses the design derived from the classic look of Microsoft Windows and a small subset of the Win32 API, but it has an entirely different hybrid kernel [3].

This application retrieves the necessary data from the XML file via a Web service and continues by processing them into graphs. To maintain the universality of application usage, the option to enter own values to measure will be available [4].

To create an application development environment of Microsoft Visual Studio 2008 in programming language C # is used. Microsoft Visual Studio 2008 C # is a powerful programming language, focused at application developers on .NET Framework [5].

## 2. Problem definition

Temperature, pH and conductivity measurements of dampening solution on offset printing is an important part of the printing process. The principle of offset printing lies in the fact that the printing plates for printing are firstly during the printing moisturised and layer of moisture remains on the non-printing areas. Then the uniform layer of ink is fed on the surface of the printing form by the system of roller cylinders, which attaches to the printing areas. This color is then transferred from the printing plate to the portable (offset) cylinder and from the cylinder to the substrate being printed. Indirect transmission via a portable paint roller allows you to print on various substrates. [6]

Moisturising instrument is, besides the printing plate and offset printing ink, the third most important factor in offset printing. By optimum interplay of these system components perfect print results is achieved, even at high production speed. Moisturising instrument should ideally have a pH from 4.8 to 5.2 with a conductivity of 1500-1700  $\mu\text{S} / \text{cm}$  and a range of temperature from  $-10^\circ \text{C}$  to  $15^\circ \text{C}$ . Using the universal control measuring instruments the value of pH, temperature, as well as conductivity can be determined. All electronic measuring equipment need to undergo periodic calibration. [7]

Printing machines are from the factory equipped by these devices. Based on the values of these measuring devices the dosage of additives into the moistuiring instrument is regulated to reach the desired values. As already mentioned, these devices must be calibrated at regular intervals. To check the proper calibration and performance of additives dosing it is appropriate to use independent measuring device.

Apparatus for measuring the electrolytic conductivity are many years the basic tools for analyzing fluids, solutions and finished products in various industries. Electrical conductivity G is generally a revolutionary value of resistance R and its unit is the Siemens (S). Contact measuring probes have two or four electrodes that directly interfere in the test solution. Probe cable is connected to the measuring transducer. The transducer probe is supplied with alternating current or voltage with sinusoidal or rectangular course suitable amplitude and frequency. From this it leads analog signal proportional to the conductivity designed to be strengthen and further processed to the transmitter. [8]

For quick and effective conductivity measurement it is ideal to use a portable conductivity meter. As an example, a model of CDH-280 Omega is taken. This model is the basic unit for measuring conductivity. It comes in a convenient carrying case. The basic kit includes meter, glass conductivity probe with integrated temperature sensor and a constant 1.0. Self evaluation unit has 4 selectable ranges and it is very easy to use.

Measuring ranges from 200  $\mu\text{S} / \text{cm}$  to 200  $\text{mS} / \text{cm}$ . The set can be supplemented by a plethora of alternative probes constants of 0.1 to 10 in various versions - glass, epoxy, polymer. [9]

In the case of temperature we have a plenty of temperature sensors and measuring devices contact and contactless. Temperature can be measured by a number of different sensors. Using all sensors the temperature is derived from sensitivity to a change of physical quantity. Usually we come into contact with six types of temperature sensors: thermocouples, resistance thermometers and thermistors, infrared thermometers, bimetal thermometers, sensors and transducers expandable fluid, change of status. In our case it is sufficient to use the sensor with change of resistance (RTD).

Temperature sensors with change of resistance use electrical resistance changes of the material depending on its temperature. Two key types are resistance thermometers and thermistors. Resistance thermometers are based on the resistance change in metal with a temperature more or less linearly increasing. Thermistors are based on the resistance change in a ceramic semiconductor, the resistance decreases nonlinearly with increasing temperature. [10] With today's technology more variables can be measured on one instrument. This is the appropriate use of scanners, sensors and evaluation device. Device can be Control Panel - OP, PLC, building blocks specially designed for the application. An example of such use of the device may be the device supplied by Technotrans. [11]. To similarly demanding applications, we can use the commonly used PC, in the best case pocket PC - PDA. The PDA in addition to small size offers Bluetooth connectivity, WiFi, USB. With the right software in, the PDA turns into measuring device capable of evaluating more data at once. It just depends on the use of suitable sensors and transmitters.

The above-mentioned temperature and conductivity meters are suitable for use especially if you want to quickly and effectively measure the desired quantities. However, no record and a subsequent evaluation of measured data. Measuring using the PDA allows you to write data. But PDA has to somehow get the data. Therefore, in conjunction of measuring conductivity and temperature probes a converter AD4ETH creates a PDA convenient source of information about the measured physical quantities. PDA itself needs the appropriate software to function as well- applications. Which is the topic of this article.

### 3. New solution

As the input part analog-digital converter AD4ETH developed by Papouch Ltd. is used. As already mentioned, it is a four-channel transmitter with two voltage and two current inputs. Current inputs should be used to connect the conductivity sensors, which have a current of 4-20 mA. Voltage inputs have input range 0-10V and they are used to connect temperature sensors PT100. The measured values are processed by analog multiplexed 16-bit sigma-delta A/D converter, see. Figure 2 block diagram of a transducer. Fig. 2

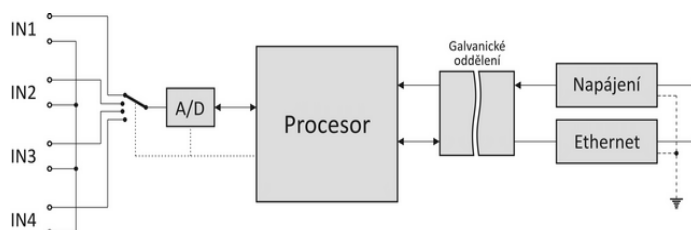


Fig. 1 Block diagram of the measuring transducer

The main advantages of the converter is its ability to communicate over a computer network 10/100 Ethernet. Since the measured data is stored in an XML file, this data can be processed in your own application. AD4ETH has its own website on which you can monitor the measured values and also configure it.

### 4. Implementation

Application is made in the programming language C # in development environment Microsoft Visual Studio 2008 it. NET Compact Framework, May 3. Which is a platform designed specifically for mobile

applications (Smart Device). Compared to standard .NET Framework, designed for desktop applications (Windows Form Application), this platform is greatly limited in use of different libraries and toolboxes, to which we are in .NET Framework used to. And that's just a stumbling block for any application development for mobile applications. We can only rely on basic functions .NET Compact Framework. Since the original intention to use the application to display the values of a transmitter and a graph was dropped by because of missing libraries. So we have to settle just with the call for values.

Retrieving file is performed by first assigning a string to URL address, which will continue to work. For instance:

```
XMLFileURL const string = @"http://192.168.50.250/data.xml";
```

Since the PDA emulator in Visual Studio is behaving like a real PDA and a PC running has nothing to do with that, therefore, no disks, you must configure (map) directory, which will act as a storage memory in the PDA.



Fig. 3 Example of Opening XML file directly in the PDA via a URL address

Settings folder in the emulator is as follows:

In the File tab select Configure then in Shared Folder specify the path to the directory you want to map as a storage drive in a PDA emulator.

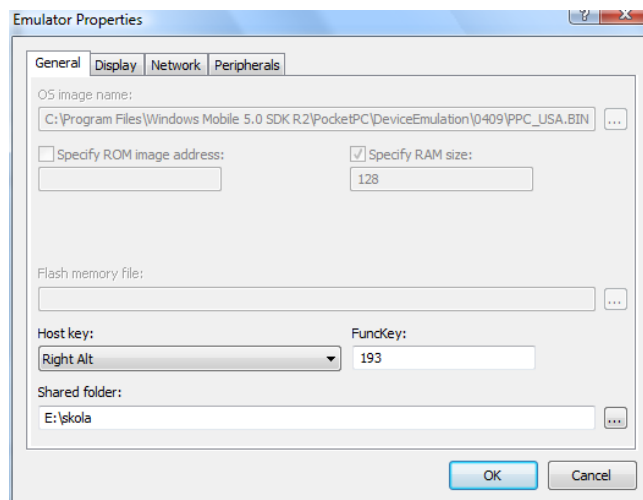


Fig. 4 setup of a storage

## 5. Conclusions

Even though we did not meet the requirement of the original award and display the values in graph, the project was beneficial for me in programming in Visual Studio C # .NET Compact Framework. It is a pity that the mobile application does not have so many libraries that could be freely used, as it is in the case of .NET Framework. As we discovered, Microsoft is not already continuing in development of Windows Mobile 6 and develops a new system for mobile devices Windows Mobile 7. Perhaps we'll see better support in this area of programming for these devices.

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