

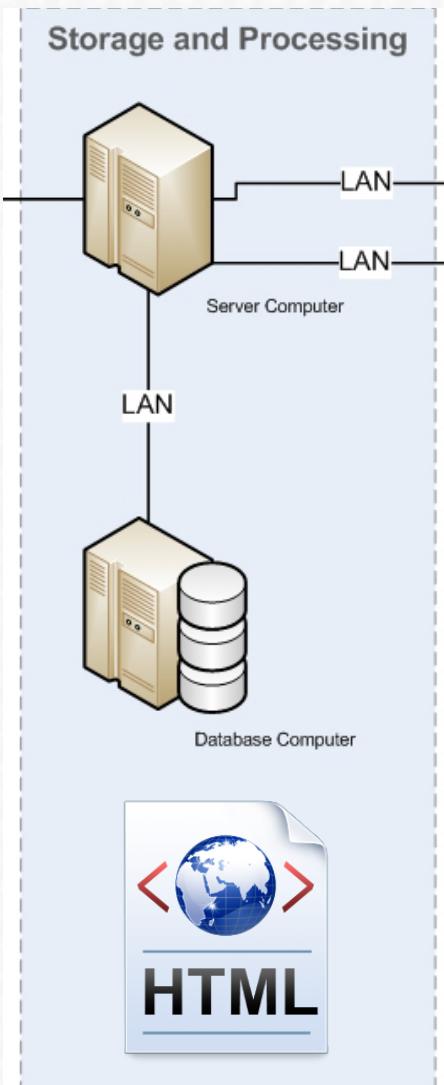
UNIVERSITATEA „TRANSILVANIA” DIN BRAŞOV
FACULTATEA DE INGINERIE ELECTRICĂ
ŞI ŞTIINȚA CALCULATOARELOR

Retele de senzori

Curs 3 - 1st edition

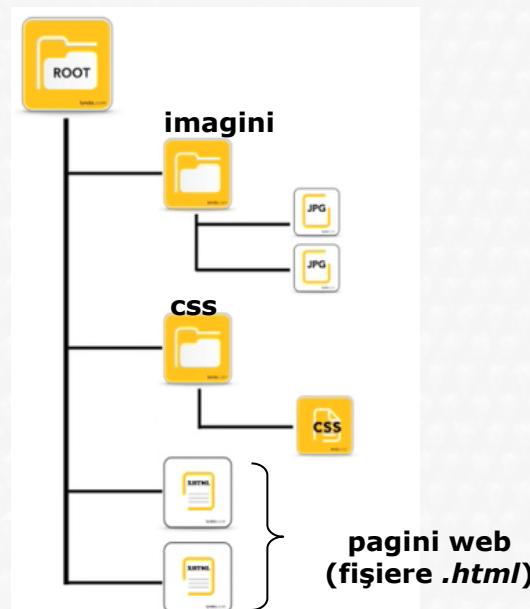


Communication protocols - HTTP



- HTTP (HyperText Transfer Protocol)

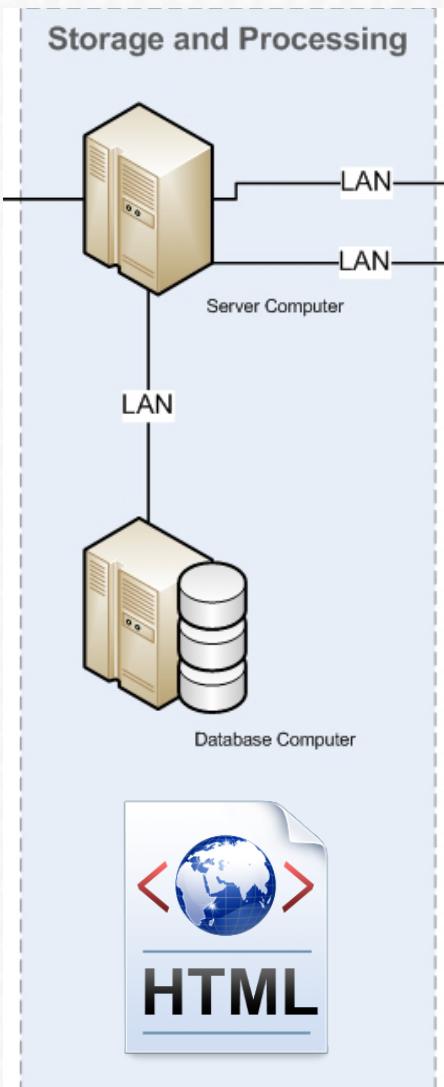
- dedicated for accessing the information on Internet ;
- a URL (Universal Resource locator) is necessary to identify a folder or a file with information;
- the HTML (HyperText Markup Language) language is used to create web pages.



Example HTML file:

```
<html>
  <head>
    <title>Example</title>
  </head>
  <body>
    A simple example ....
  </body>
</html>
```

Communication protocols – HTTP (laboratory)



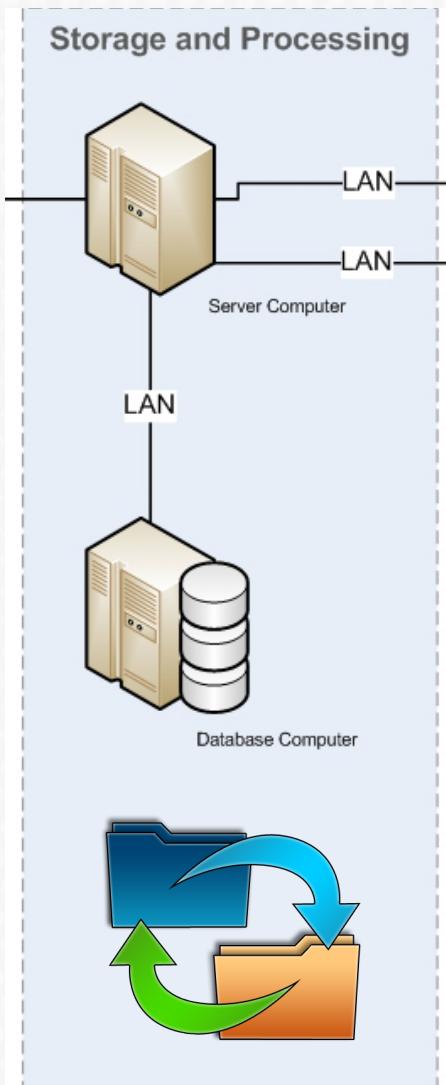
You have to create a single web page (*monitoring.html*) which to display the measured values of 3 parameters (temperature, relative humidity and dew point) and 2 buttons for start and stop the air conditioning system.

```
<html>
  <head>
    <title>Monitoring and control</title>
  </head>
  <body>
    Temperature: <strong>25.65 degree Celsius</strong><br />
    Relative humidity: <strong>47.78 %</strong><br />
    Dew point: <strong>16.17 degree Celsius</strong><br />

    <form>
      <input type="button" value="Turn on"></input>
      <input type="button" value="Turn off"></input>
    </form>

  </body>
</html>
```

Communication protocols

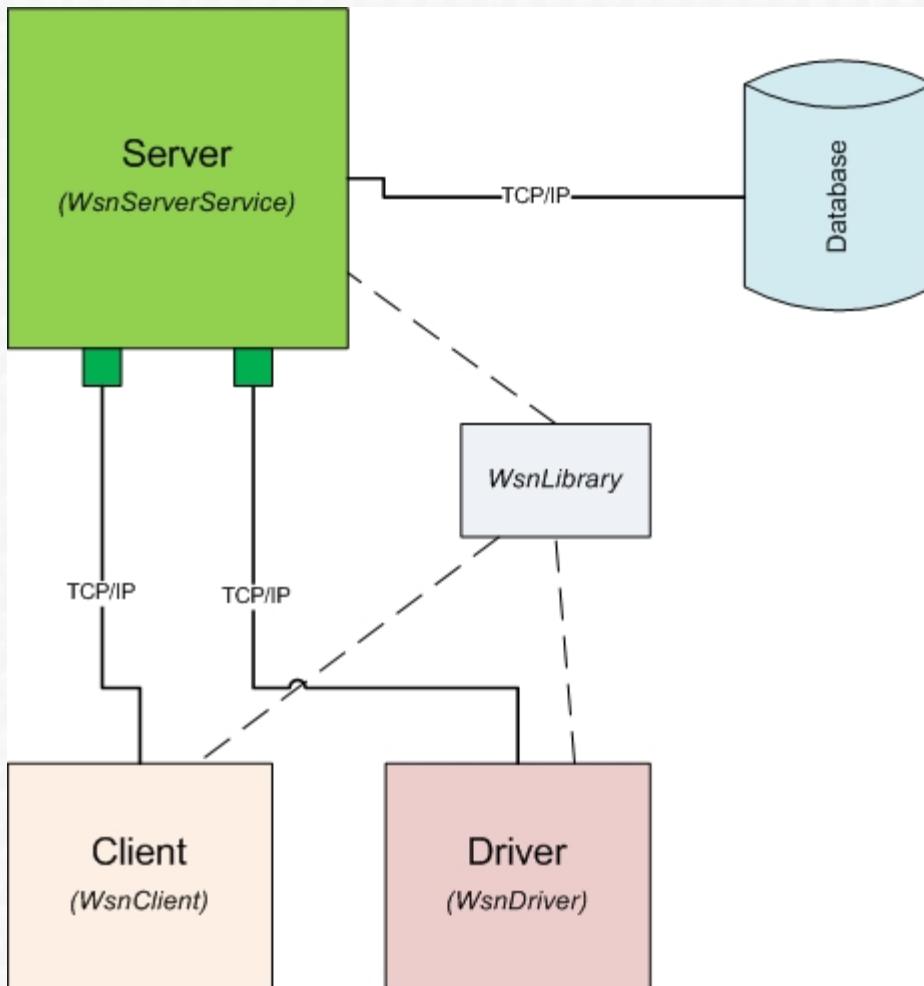


- FTP (File Transfer Protocol)
 - used to transfer files from a computer to another computer
- TCP/IP (Transfer Control Protocol/Internet Protocol)
 - base protocol for information transmission
 - have the highest data transfer rate, compared to the previous presented ones
 - it is generally used to realize the communication between different software application from a system.
 - usually is a server application and multiple software applications (on each side a socket object is required to be created)
- A TCP/IP *socket* is described by:
 - an IP address;
 - a port number.

Into a server-client system, usually on the server side, it is open a socket with a specific port and client applications will connect to that socket (for information exchange). The socket from the server has to listen if there are any client applications which require to connect to it, and if there are it will allow the connection or not (some security procedures should be also implemented).

The port of the socket should not be blocked by the firewall if you want that the connection to succeed.

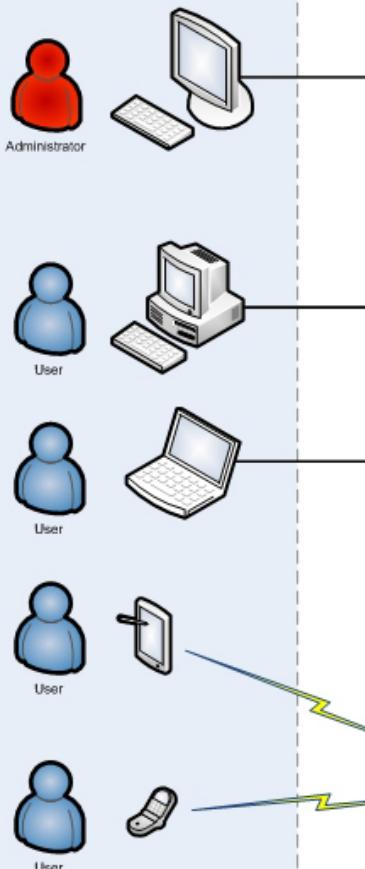
Communication protocols – TCP/IP system example



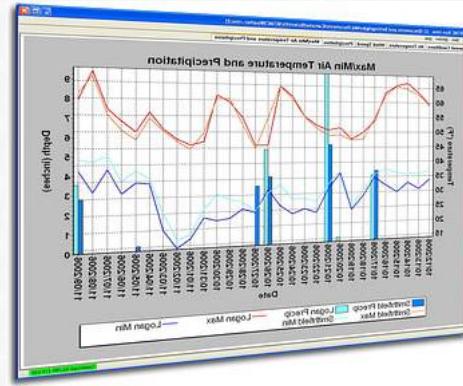
- only the Server application communicate directly with the database for storing and process the information (the TCP/IP communication is done automatically using a proper configuration)
- on Server side there are 2 socket objects opened for the communication:
 - one for Client applications
 - other for Driver applications
- the exchange of information is done using a common library of objects and methods (WsnLibrary)
- to be sure that the information is exchanged correctly some verifications methods should be applied
- also cryptation of the data could be done for security reason

User interface

Client View/Analyze

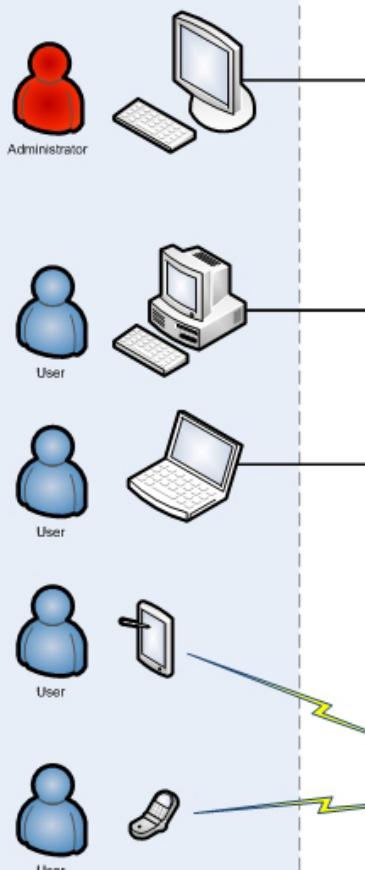


- web applications (an example was presented before with that HTML file from laboratory)
- Windows application (or for other operating systems) for computers and mobile devices
- SCADA (Supervisory Control and Data Aquisition)

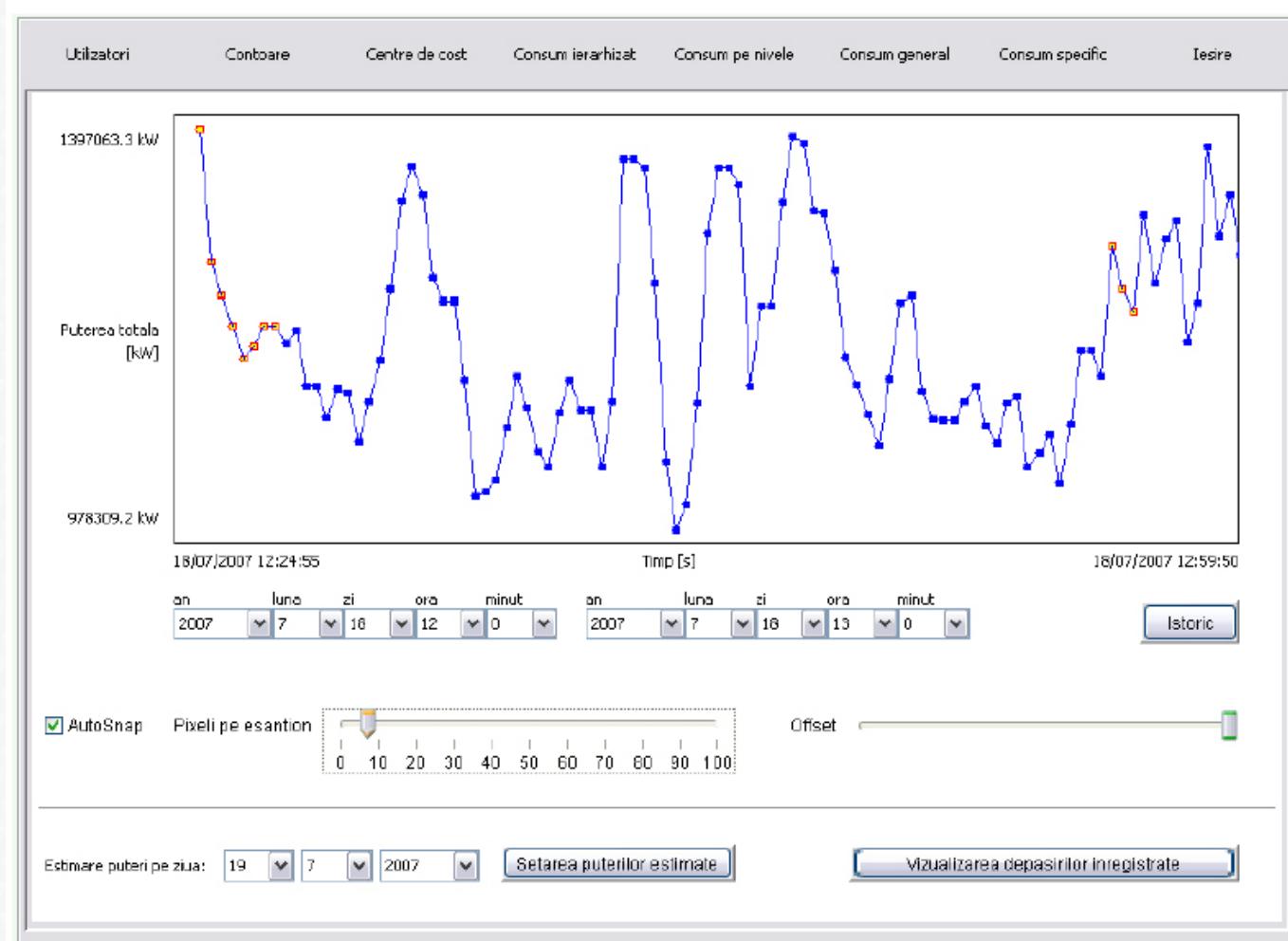


User interface – web applications

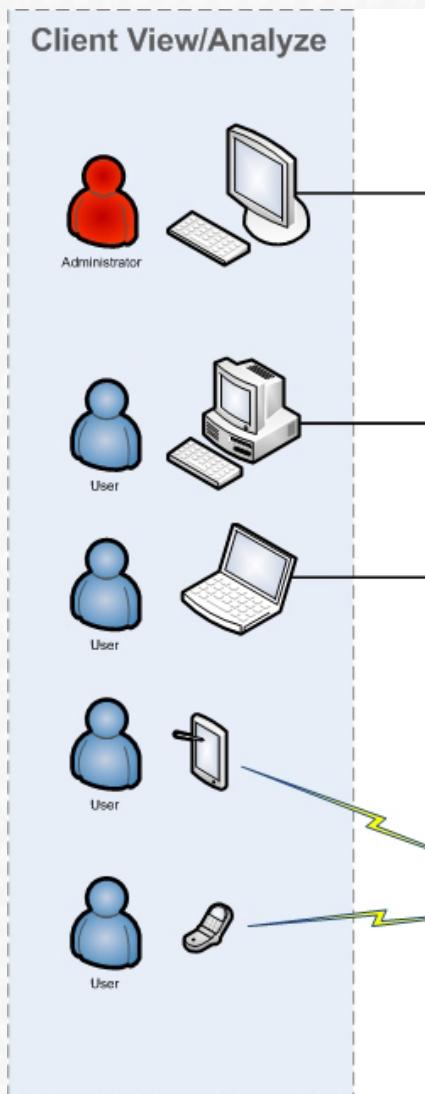
Client View/Analyze



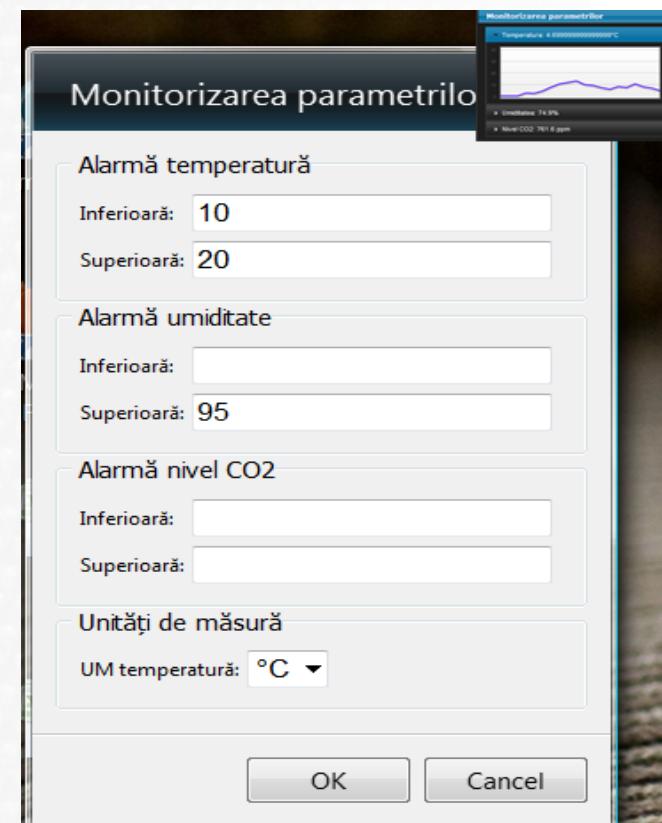
- applet Java integrated into a web page



User interface – Windows applications

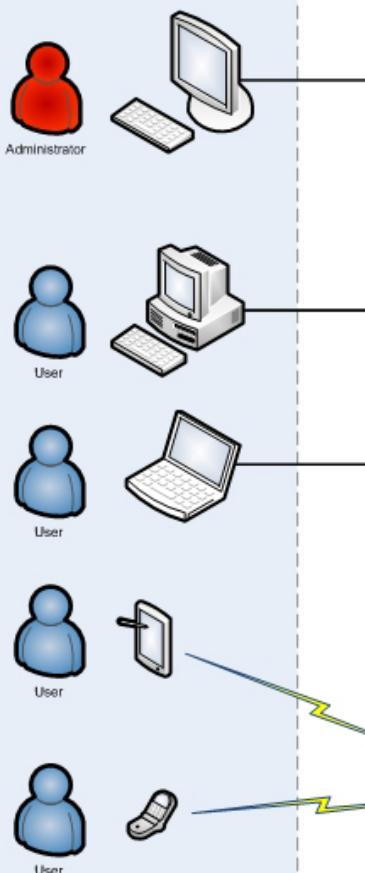


- a special case would be a Windows Gadget which displays the measured parameters values (available only for Windows Vista or 7)
- a gadget it is like a web application (use HTML language to create it)



User interface – Windows applications (laboratory)

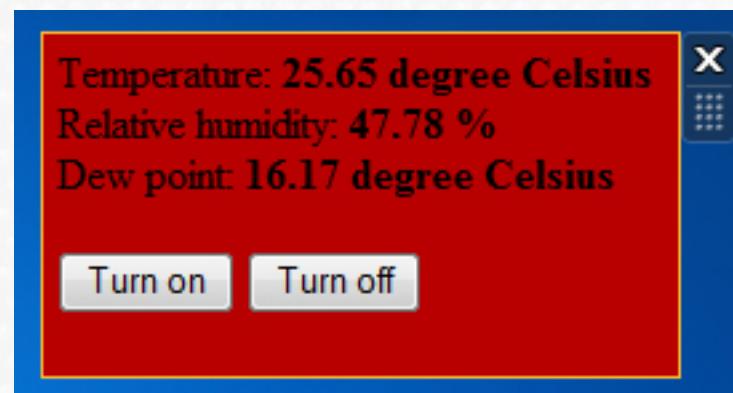
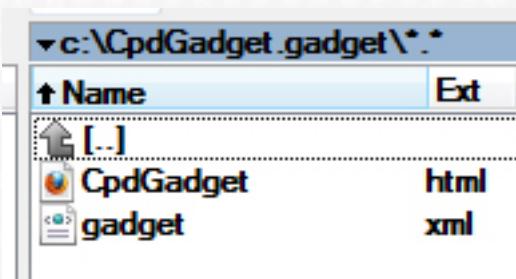
Client View/Analyze



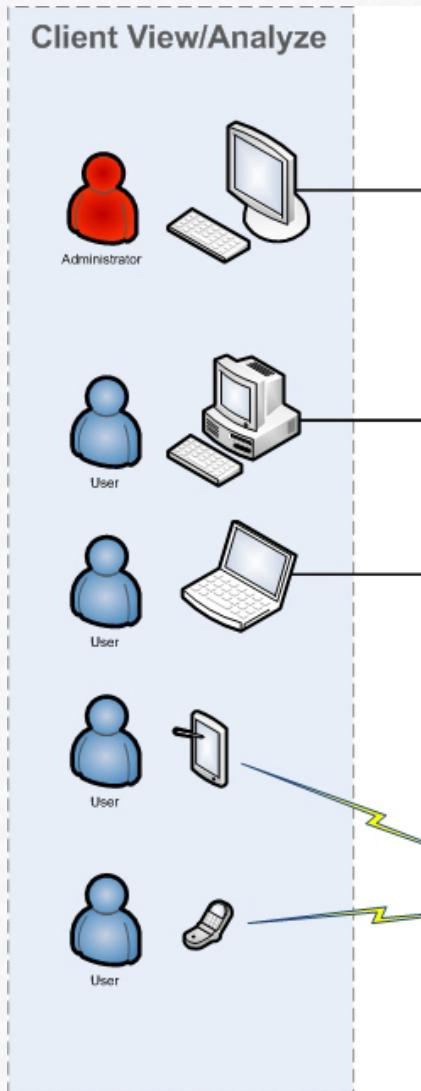
- a Windows Gadget has to include at least:
 - a configuration file (for defining the name, version, description, author, icon etc.) – it is a XML file;
 - a HTML file for defining the Gadget design.

All the files have to be put into a single folder <GadgetName>.gadget. It is important that the folder to have the extension “.gadget”.

After the design of the gadget is completed the folder has to be copied in *Program Files/Windows Sidebar/Gadgets* folder. From this moment, if the application has been created correctly it will appear in the list of available gadgets.



User interface – Windows applications (laboratory)

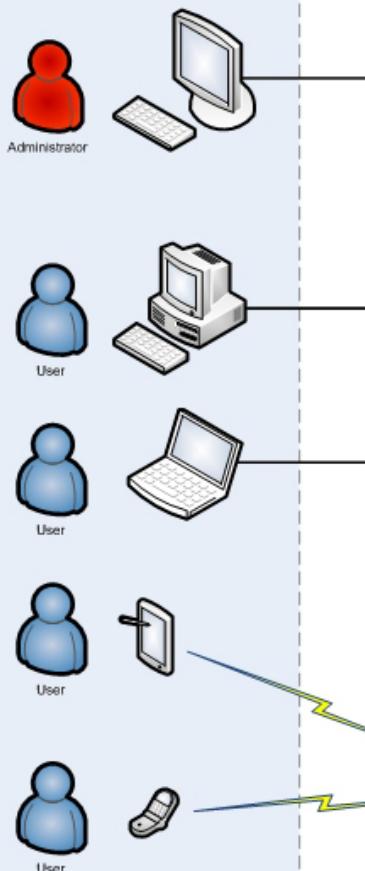


Configuration file: *gadget.xml*

```
<?xml version="1.0" encoding="utf-8" ?>
<gadget>
  <name>Cpd Gadget</name>
  <version>1.0</version>
  <author name="aaa bbb">
    </author>
  <description>a simple test gadget</description>
  <hosts>
    <host name="sidebar">
      <base type="HTML" apiVersion="1.0.0" src="CpdGadget.html" />
      <permissions>Full</permissions>
      <platform minPlatformVersion="1.0" />
    </host>
  </hosts>
</gadget>
```

User interface – Windows applications (laboratory)

Client View/Analyze



Gadget design file: *CpdGadget.html*

```
<html>
  <head>
    <title>Monitoring and control</title>
  </head>
  <body style="width:240px; height: 130px; margin: 0px; padding: 5px;
background-color: #B80000; border-style: solid; border-width: 1px; border-
color: #FFBD32;">
```

Temperature: 25.65 degree Celsius

Relative humidity: 47.78 %

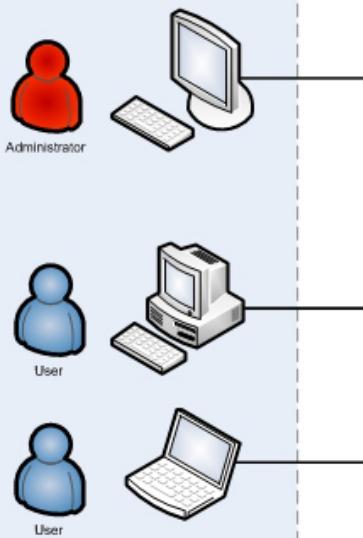
Dew point: 16.17 degree Celsius


```
<form>
  <input type="button" value="Turn on"></input>
  <input type="button" value="Turn off"></input>
</form>
```

```
</body>
</html>
```

User interface – Windows applications (laboratory)

Client View/Analyze



Create a simple Windows application using Microsoft Visual C# 2010 Express. It will contain a single form displaying the same information like the previous cases.

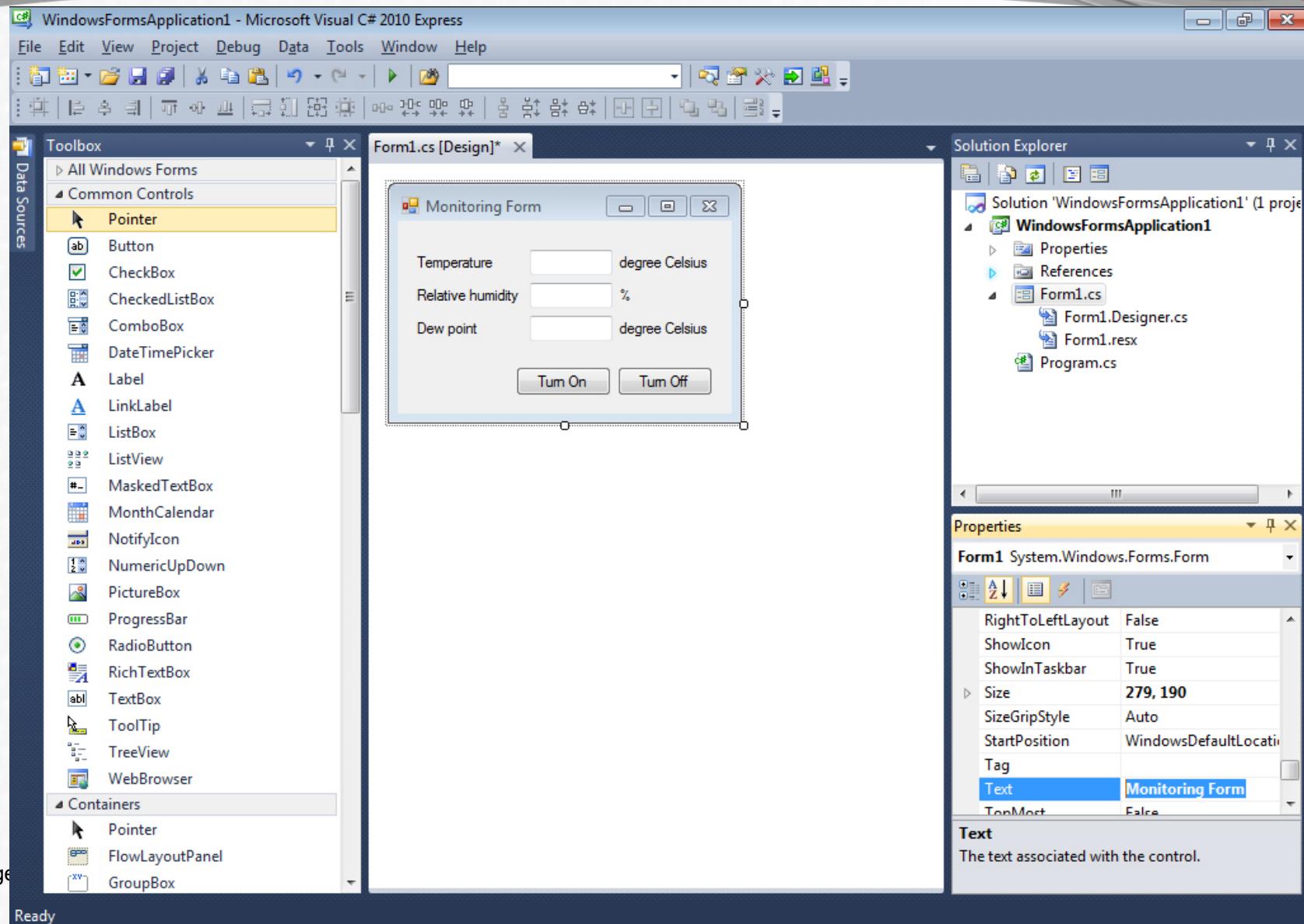
Steps to accomplish:

- start the Microsoft Visual C# 2010 Express Environment;
- create a New Project;
- at the project type select Windows Forms Application;
- after the project is created a form (the main form of the application) will be opened. Having the form selected, from Properties window different properties of the form could be modified. E.g. modify the *Text* property which represents the title of the form. The same you will have to do with the other components (controls).
- add from Toolbox window the necessary components (labels, text boxes and buttons) to the form. To add a component to the form just drag & drop it from the Toolbox window.
- to run the application press the button with a green arrow from the top toolbar.

The screenshot shows a Windows application window titled 'Monitoring Form'. The form displays three data points: Temperature (23.67 degree Celsius), Relative humidity (58.92 %), and Dew point (16.72 degree Celsius). At the bottom of the form are two buttons: 'Turn On' and 'Turn Off'.

Parameter	Value	Unit
Temperature	23.67	degree Celsius
Relative humidity	58.92	%
Dew point	16.72	degree Celsius

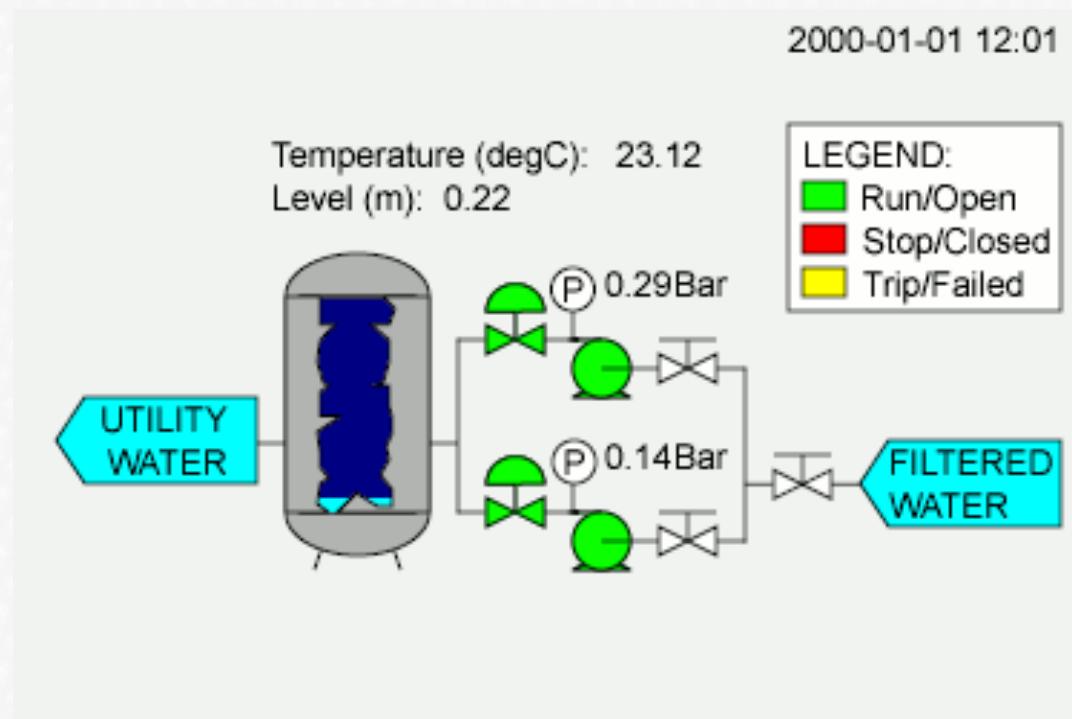
Microsoft Visual C# 2010 Express Environment



User interface – SCADA

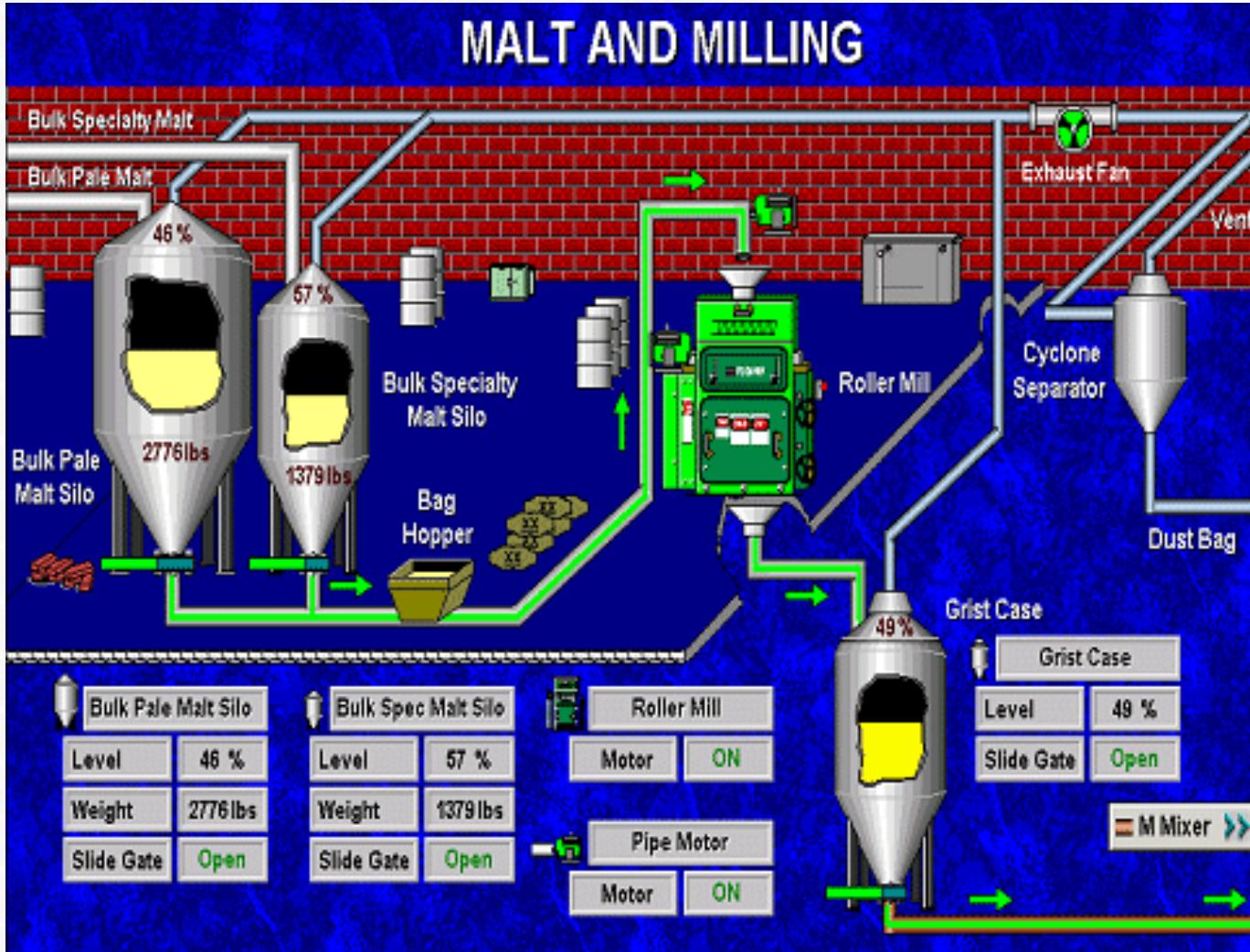
SCADA (*Supervisory Control and Data Acquisition*) is represented by a system of applications (hardware and software) dedicated specially for industrial processes control. The interface is user friendly and permit to view the state of the equipment from the industrial process and even to control them from distance.

It allows easily to represent graphically the entire industrial process and includes many animations (corresponding to different tasks which are executed).



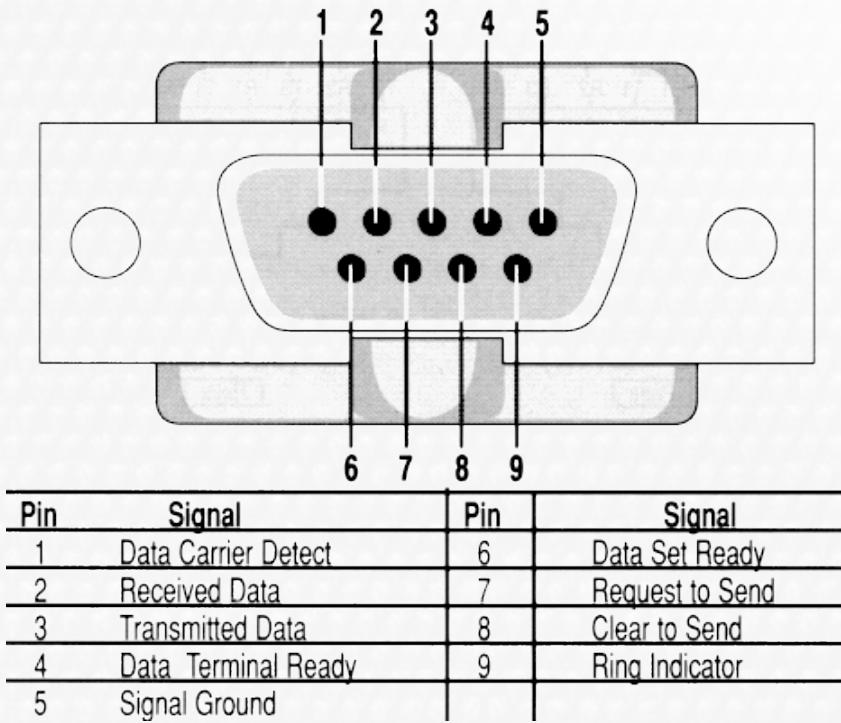
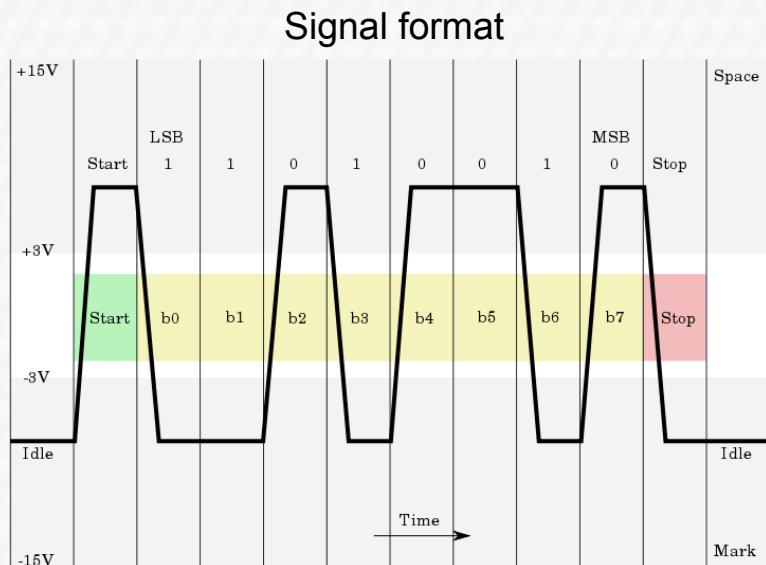
User interface – SCADA

Other process example



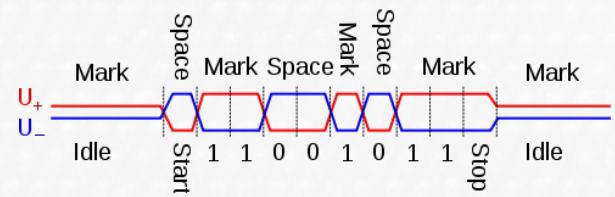
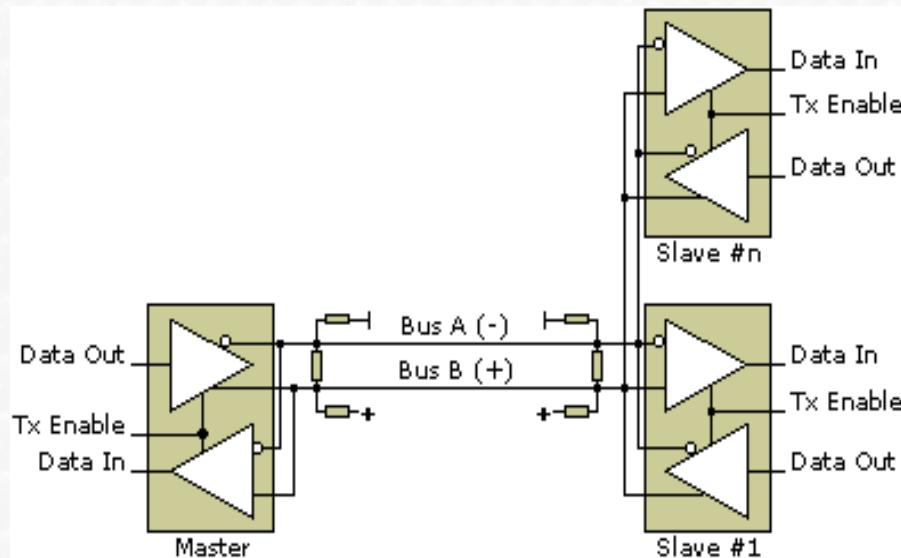
Communication standards - RS232 (serial)

Most of the computers have a serial port included. Even if it was designed to connect a printer or a mouse to the computer it could also be used to connect to different other components which recognize this communication protocol. For the computers which don't have a serial port a converter USB-serial could be used.



Communication standards – RS485

- most used in industrial environment (long distances and electrically noisy)
- allows to connect multiple devices on the same communication line
- there should be a master device on the network (the other devices will be slaves)
- a differential line is used for transmit the data (2 wires: + and -)
- each slave has a configured identifier for being able to detect if a request is send to him or to another slave



Differential signal

RS485-RS232 and Fiber Optic – RS485 Converters

It converts the electrical signal between RS232/fiber optic and RS485 standards. And usually it needs an auxiliary power supply to work.



Monitoring devices – electrical meters

- Modbus protocol for communication on RS485
- It allows to measure:
 - current on 3 phases;
 - voltage on 3 phases;
 - frequency;
 - active and reactive power;
 - active and reactive energy;
 - power factor.
- Store logs about the encountered errors.



Sepam 1000



PowerLogic Power Meter 210

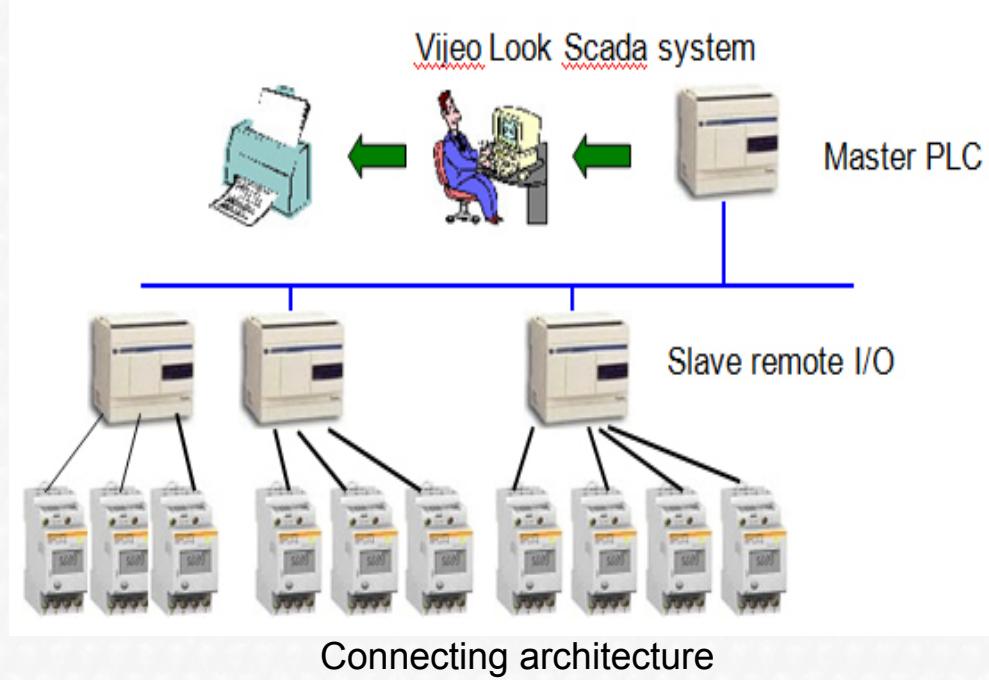


Monitoring devices – electrical meters

- with electrical impulses output
- at each 1kW an impulse is generated
- it requires an additional device for counting the impulses and store this information even it is powered off
- it is cheaper than Sepam



Me1zr



Monitoring devices – electrical meters



Power Logic PM9C



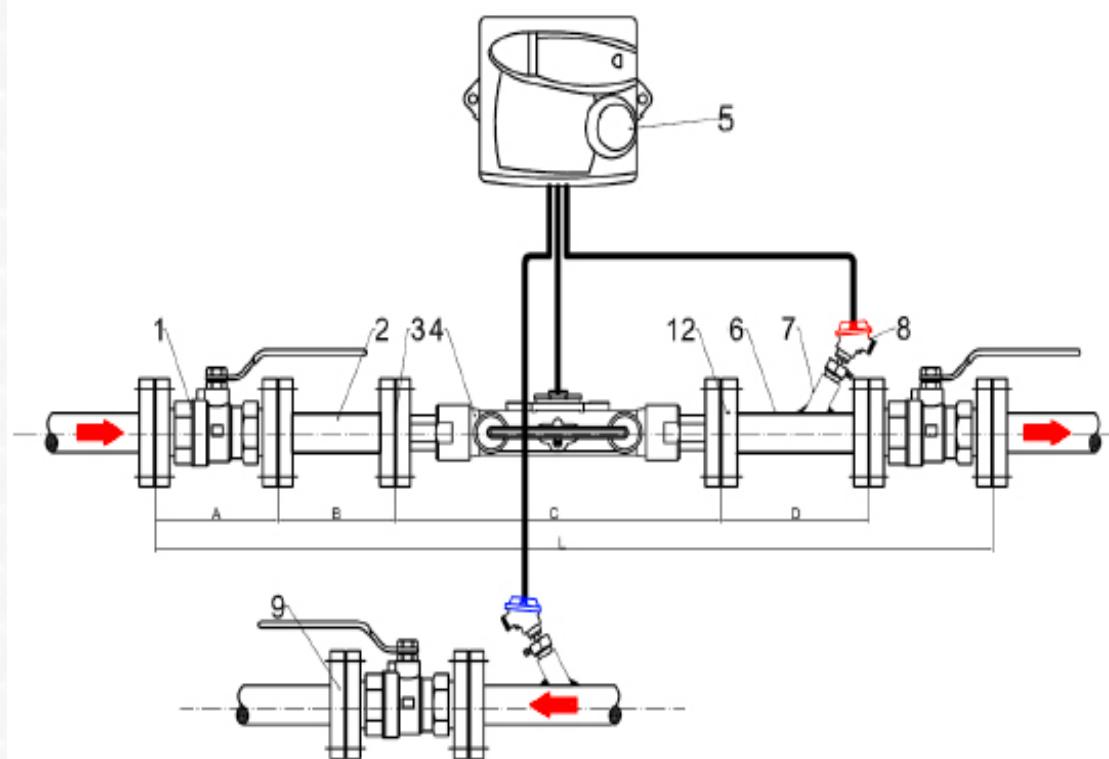
PLC (Programmable Logic Controller)

- is a digital computer used for automation or electromechanical processes
- in its memory a program could be loaded
- has digital inputs and outputs and analogic inputs
- E.g. Twido TWDLCAA10DRF



Monitoring devices – thermic energy meters

- MBus communication protocol
- It is constructed from 2 devices:
 - a computer which measure the temperature of the water from input and output
 - a flowmeter to determine the quantity of water which pass through radiator



Monitoring devices – water meters

- for hot and cold water
- generate electrical impulses as output for monitoring
- 1 impulse at 1 m³ of water



Electrical energy, thermal energy and water consumption metering

Preț tablou monitorizare: 111,40 lei
Preț monitorizare consum energetic: 4010,38 lei
Preț monitorizare consum agent termic: 9556,28 lei
Preț monitorizare consum apă caldă-rece: 2137,80 lei
Preț total: 15715,86 lei

