THE BASIC WAY OF REALIZATION OF THE MEASUREMENT SYSTEM COOPERATING WITH PC INTEGRATED TO STUDY SUPPORTS USING FLASH ANIMATIONS

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Abstract
Current educational technologies place a special emphasis on implementation of measurement systems directly into study supports.
The Masaryk University Department of Technical and Informational Education has been dealing with this topic for a considerable amount of time. That is one of the reasons why the experimental prototype of binary counter cooperating with PC was created.
The article shows the basic way of realization of the measurement system - it shows its functioning and describes the communication between the counter and PC. This article also shows the communication between a Flash animation and a program created in Visual Basic.

1. Introduction
It is not so common nowadays to interface measurement systems cooperating with PC and interactive learning environment. A direct integration of a measurement system into interactive distant supports offers new possibilities of using them in education. Flash makes possible a close cooperation of graphic designers, programmers and teachers. The advantages of using Flash for creating interactive study supports are well known, but the fact that it is possible to integrate Flash animation directly into the system cooperating with PC, or even a possibility to control hardware applications connected to ports of PC, is quite rare. This makes possible for us to create a brand new study support which can directly cooperate with a connected measurement system – it can pass data, control the measurement system or receive measured values. Merging study materials, teaching simulations and counting systems makes possible to use measured data directly in the study support and it also makes possible to compare theoretical hypotheses with real values, which improves clearness of interpretation and also improves the way of processing and evaluating a practical measurement.
We expect this combination to bring new opportunities to teaching and to extent using of study supports created in this way.
We chose a counter which makes possible to realize a large amount of various measurements as the first application of the measurement system.
Our aim was to create an easy to construct, compact and not expensive counter cooperating with PC, and to design a simple but reliable communication protocol between the measurement system and PC.

2. Description of behavior of the control system of PC
When a user starts the educational program, he receives basic information about the state of the system. The user has an opportunity to choose the COM port via which the HW of the counter is connected. Then the interface of Visual Basic tries to get access to the chosen COM port.

- If opening the COM port fails for any reason, a message “Port COM X is not available” is displayed.
- If the port is opened successfully, the program sends a request for IDENTIFICATION and waits for an answer. This state is indicated by a message “Connecting…” and the state of hardware is set to “No device connected”.
    - If there is no response for a defined interval of time, the state of waiting for an incoming request for IDENTIFICATION from the COUNTER is activated.
    - If any different information than IDENTIFICATION is received, a message “unknown device” is displayed and the state of waiting for an incoming request for IDENTIFICATION from the COUNTER is activated.
    - If there is a correct response received during a defined time interval, the state of HW is set

to “Device connected”.

Then an option to run the measuring becomes available. When the measuring begins, PC sends a request to start the measuring to the COUNTER. Then begins a waiting period for results of the measuring.

- If no results are received, a message “Connection error” is displayed
- If any results are received, a confirmation message about receiving the results is sent together with:
  - A command to begin a new measuring
  - A command to quit the measuring
  - A command to sent data again because of an error

3. Description of behavior of the hardware of the counter

After activating the device, the COUTER sends a request for IDENTIFICATION and waits for a defined time interval for a response from PC.

- If a correct answer is received, a green LED is lighted up, which indicates that connection with software of PC was successful.
- If no answer is received, a red LED is lighted up, which indicates that connection with PC was not successful, and the counter waits identification from PC to income.

After successful IDENTIFICATION, the COUNTER waits for a command to begin the measuring. During the period of measuring, the green LED is blinking and counting is running for the period of one second. When the measuring is finished, the COUNTER sends the results to PC. Then the COUNTER waits for a defined period of time for a confirmation about receiving the results.

- If any results are received, the measuring can end, begins or the results can be sent again.
- If no results are received, the red LED starts blinking, indicating an error in connection. In order to start a new measuring it is necessary to shut down the system and then run it again.

4. The realization of the system

The counter is based on a single-chip microcontroller PIC16F84 which communicates with PC via RS232C bus. The advantage of this solution is an easy way of communication with PC, and a possibility of a mutual connection of the counter and PC via USB or Bluetooth. The graphic interface is created in Adobe Flash, which offers almost unlimited possibilities in creating multimedia study supports with internal intelligence, which creates the learning core of our system. Because we are dealing only with an experimental sample, the creation of a high-performance graphic interface is still in progress. The communication with COM port is realized using Visual Basic at the side of PC, which makes possible to use API functions of OS easily. For a better understanding, you can see the scheme below.

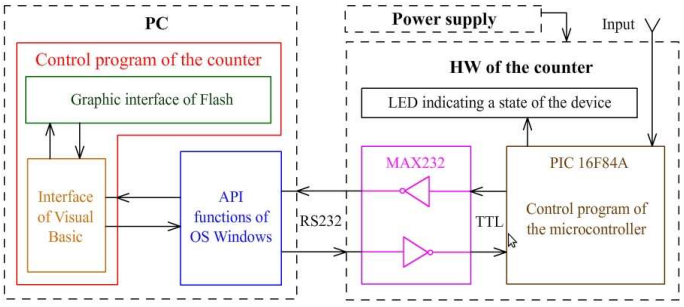

Figure 3: The scheme of the whole system

5. Communication protocol

From the description above indirectly results the communication protocol between PC and HW of the COUNTER. For an easier orientation in the program and its debugging it is better to show the communication protocol between devices. In the first picture, you can see the synchronization

between devices according to standard used protocol. In the second picture, you can see the measuring cycle.

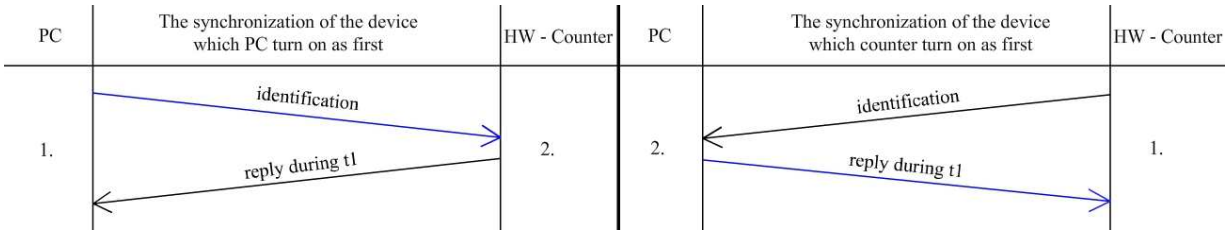

Figure 1: Communication protocol – the synchronization of the device

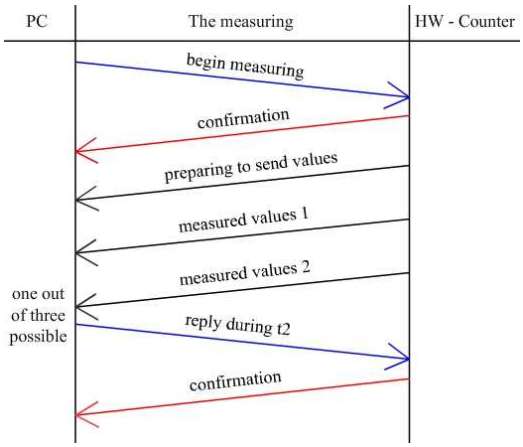

Figure 2: Communication protocol – the measuring cycle

6. Conclusion

Current trends in education require using new and new styles of teaching. A direct integration of the measurement system to an interactive study support is quite a unique solution which is not so widespread nowadays. Thanks to the opportunities which Adobe Flash gives us, it is possible to create illustrative study supports with internal intelligence and elements of playfulness. Therefore students have many new possibilities of gaining information in an interesting way with help of modern information and measurement technologies. This article shows the basic ways of realization of the measurement system. I am also engaging with designing the communication protocol and with the functioning of the whole system.

The aim of this contribution is to introduce this topic and to make possible for creators of study supports to easily design and integrate measurement systems cooperating with PC into their applications.

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