Weather forecast station with Arduino

Countries:	Czech Republic	Hungary
Suitable for grade:	3	3-4
Specialization:	IT	IT
Responsible teacher:	Zuzana Paučková	Tamás Kósa

Project description:
Data from weather station sensors (temperature, humidity, pressure, direction) collects ARDUINO. Visualize on a local character LCD eventually www page. The partner produces the hardware part of the project and programs HW tests on ARDUINO.
Weather station for measuring and displaying indoor and outdoor climate conditions.
The task of the weather station is to measure and display the outside and indoor climatic factors of a building. The station measures the ambient temperature, the air pressure and the humidity outside the building, as well as the room temperature and the humidity inside the room. The measure values are displayed on a single graphical interface on a monitor screen. In addition, it stores the sampled values at specified times, based on it prepares retrospective change graphs and weather forecasts.

Project tasks:
Student #1 (CZ):
- To consult sensors with the partner
- To build a provisional system
- To programme ARDUINO
- To perform simulation tests
- To write documentation bothin English and Czech language

Student #2 (H):
- To Make the final model
- To Assemble sensor and actuator
- To programme HW tests on ARDUINO
- To co-moderate weather forecasting algorithms
- To perform final tests
- To write documentation in both English and Hungarian language

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The implementation of the project:

We suggest two formats for execution.

Both are based on a microcomputer-supported, external and internal meeting unit, which is equipped with a display device and a control panel (the latter ones can be conveniently integrated). The proposed embodiment and the internal units according to the next chapter. The embodiment of the system is illustrated in the following figure.

Design proposals

The following diagram illustrates the possible of the system.
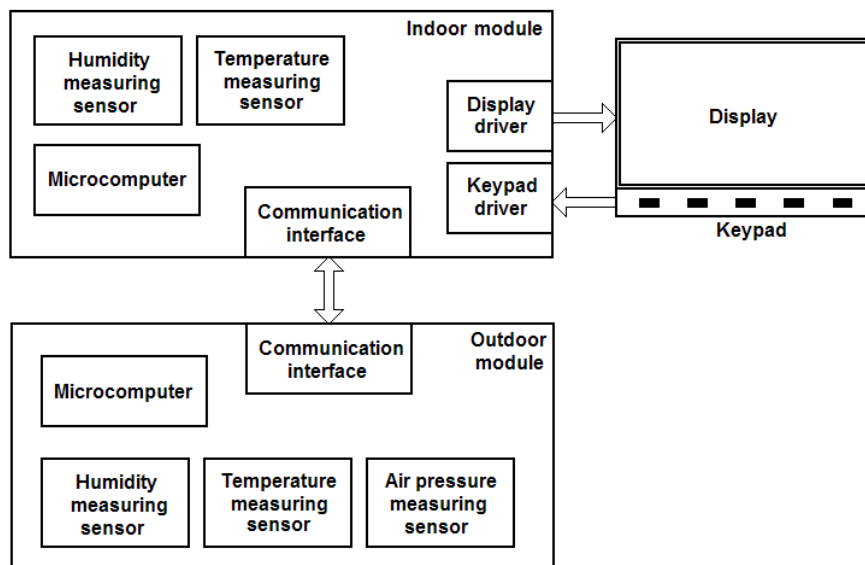
The external unit, situated outside the building, measures climatic data using sensors with the help of microcomputer. The data is transmitted through an interface to the internal unit, situated inside the building. The internal unit processes and displays the received data together with the climatic data, measured by itself. The display mode can be modofied by the help of pushbuttons. We suggest two solutions to the communication through the interface:
- with a wireless connection: in this case the external unit must have a microcomputer control
- with a wired connection: in this case the external unit doesn't need to have a microcomputer control.

1. *Weather station with wireless connection*

In this case, the communication interface can be based on any easy-to-use wireless technology such as WiFi, Bluetooth, ZigBee, Xbee, Wireless SPI, or any other short-range RF technology. The basic structure is illustrared in the following figure.
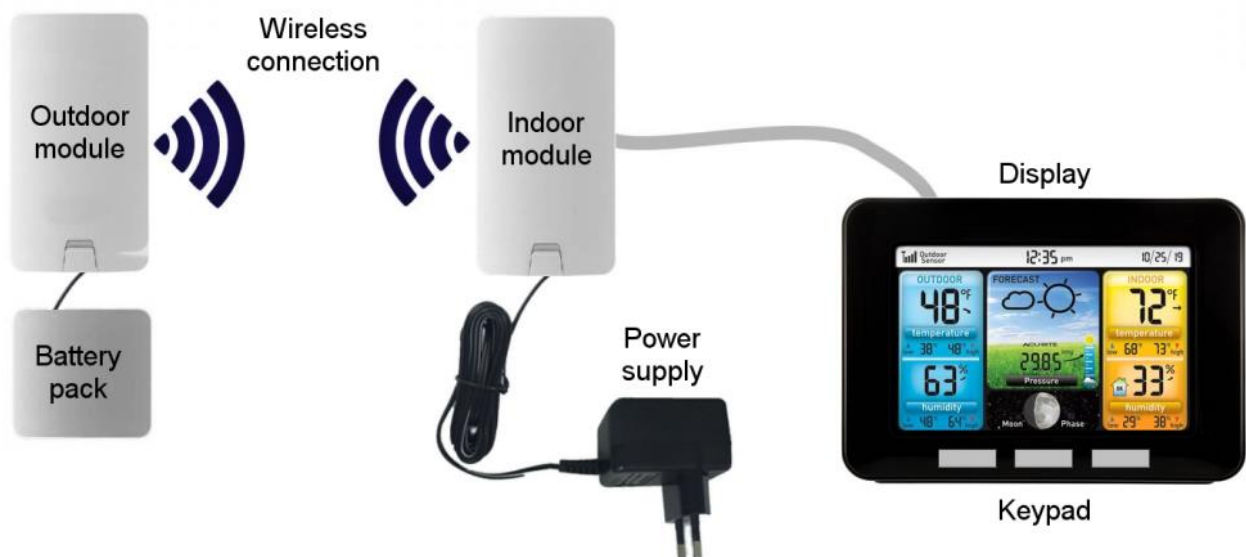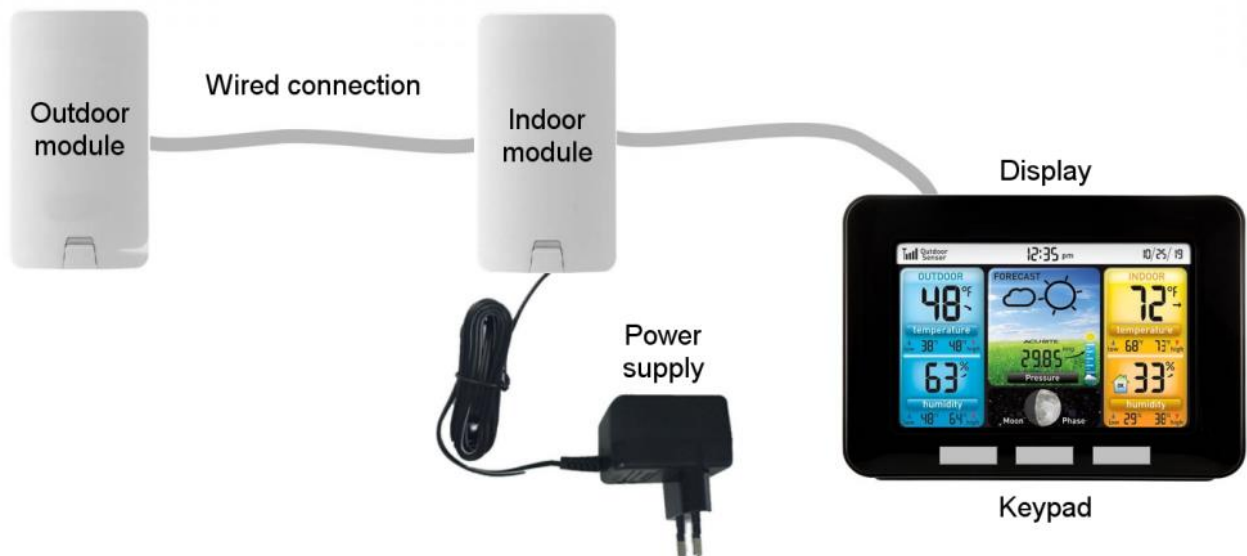

We propose to implement the concrete design using a measuring system based on Arduino microcomputers, as shown below.
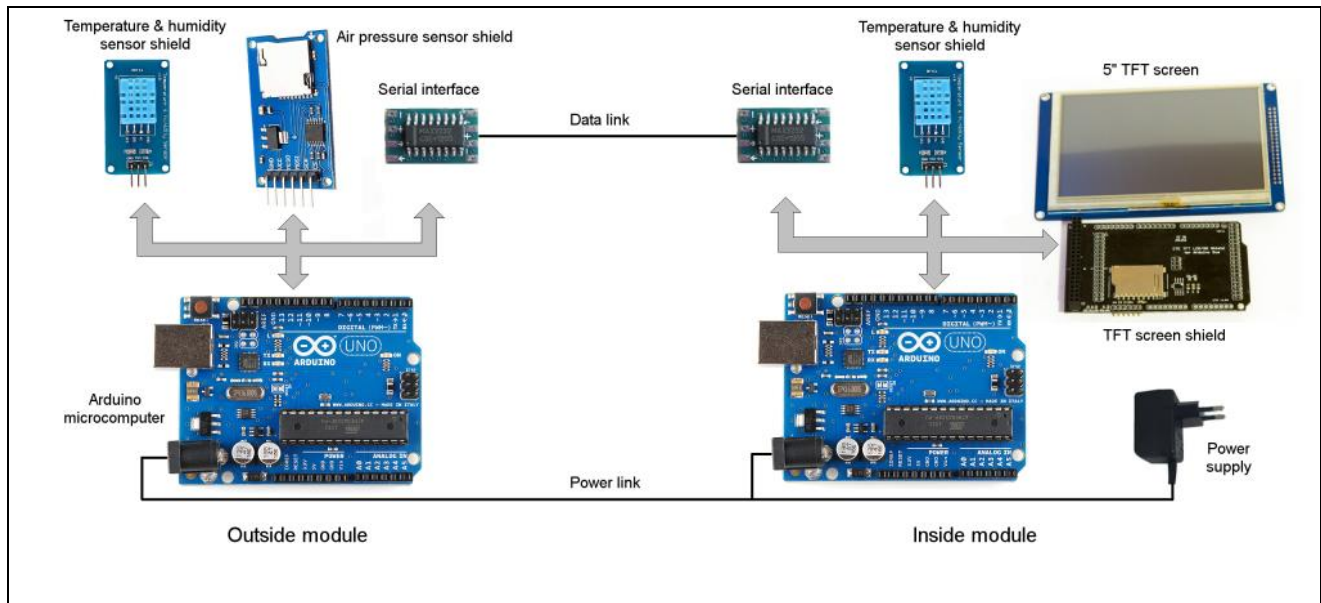
Outside module | Inside module
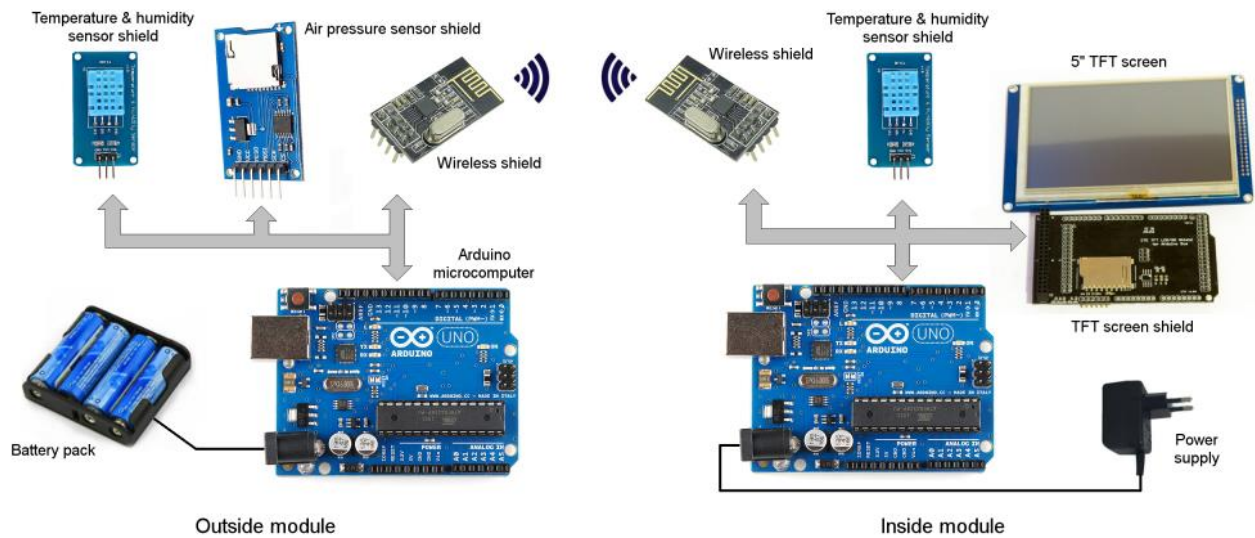
2. _Weather station with wired connection_

In this case, the communication interface can be based on any serial, SPI data transmission technology. The basic structure is illustrated in the following figure.

We propose to implement the concrete design using a measuring system based on Arduino microcomputers, as shown below.
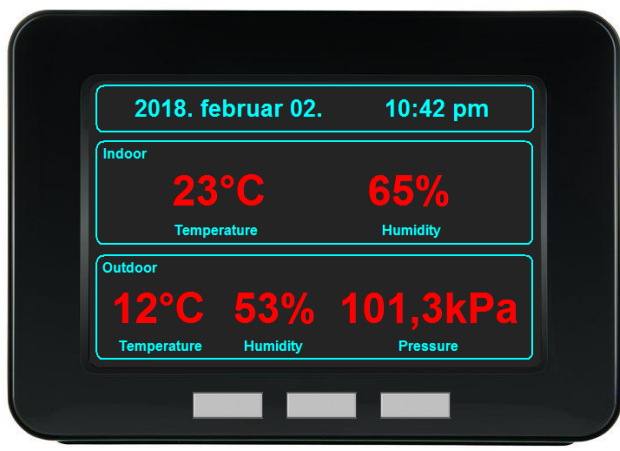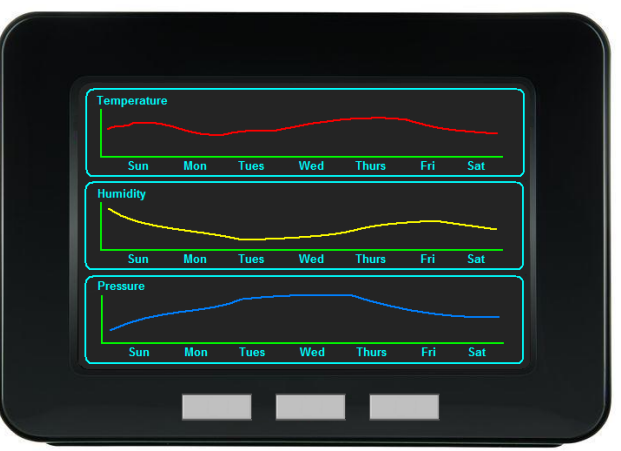
Temperature & humidity sensor shield — Air pressure sensor shield — Serial interface — Data link — Serial interface — Temperature & humidity sensor shield — 5" TFT screen

Arduino microcomputer — TFT screen shield — Power supply

Power link

Outside module — Inside module

The extra supplements of the project:

The proposed software supplements:

- Display the measured, external and internal temperature in °C, and °F, from a control panel which can be chosen by pushbuttons.
- display the external and internal pressure at kPa and bar with index-numbers, it can be selected from the control panel by pushbuttons
- display the measured storage data and the change tendencies after statistical analysis on graphs (weather forecast), which can be selected with pushbuttons on the control panel
- the keypad can be configured independently from the monitor or it can integrated with it, in touch-screen format
- the language of the displayed text can be changed (English, Czech, Hungarian, Slovak, Slovanian).

The graphical user interface

The following diagrams show a possible appearance of the monitor display. Switching between the modes can be controlled from the keypad.

Measuring mode

Forecast mode

Success criteria:

Actual data from the sensors and weather forecast are displayed on the LCD or www page

Developed hard skills:

Analysis of real problems, usage of different sources of information, programming in C language, software configuration, improvements in English language, equipment selection, trouble shooting, complex problem solving

Developed soft skills:

Communication skills, problem solving skills, creativity, team work capability