

STRUCTURE OF AUTOMATED HYDROMETEOROLOGICAL / ENVIROMENTAL STATION IN THEOREMS-DNIPRO INTERNATIONAL PROJECT

Uladzimir Vernikouski

Sukhoi State Technical University of Gomel, Republic of Belarus

Research supervisor Yury Kryshneu, PhD

Ukraine and Republic of Belarus has more than 600 km of the joint border. The border has crossed many rivers, such as Pripyat, Sozh, and the biggest one – Dnipro. At the current moment there is no transboundary water basin organization. Both countries keep in touch in different areas, but they take place just on the organization level (i.e. border guards, emergency services, hydrometeorology organizations). Other countries have already had transboundary organization that deal with water pollution and joint using of transboundary water resources, e. g. International Commission for the Protection of the Odra River against Pollution. In accordance to the Convention on the Law of the Non-navigational Uses of International Watercourses such transboundary water basin organization should do some functions, among which:

- collect, compile and evaluate data in order to identify pollution sources that generate cross-border impact;
- development of joint programs for monitoring quality and quantity of resources;
- establishment of warning procedures, without delay and by the most expeditious means available, notify other potentially affected States and competent international organizations of any emergency originating within its territory (i. e. floods, water pollutions, etc.).

As part of the project it is planned to create two unified automated hydrometeorological / ecological stations in the area of long-term hydrometeorological observations (in Belarus – gauging station «Loew», in Ukraine – gauging station «Lubech»).

The complex of scientific and engineering activities of the project covers the following aspects:

- creation of a sensor system with a set of transducers (water level, water temperature, wind temperature wind speed, precipitation, qualitative water analysis of the main pollution markers);
- development of the AHMES power supply system using the principles of «green» energy;
- capital construction of two AHMES stations in Belarus and Ukraine;
- software development for AHMES;
- development of a Web-based service for visual and numerical presentation of measured information to hydrological and meteorological services, radiation monitoring and environmental monitoring services in Belarus and Ukraine;
- creation of a telecommunication system for prompt informing the Ministry of Emergency Situations of Belarus and Ukraine about the dangerous levels of the parameters recorded.

Structurally, the hydrometeorological and ecological station AHMES consists of a data acquisition module, a required set of sensors, an information transfer module, and a power supply module. Each specific sensor in the station will measure one specific parameter.

Figure 1 shows the structural diagram of AHMES measuring station.

The most important parameters for the local people are the water quality and water level of the Dnipro River. It should be noted that in case of harmful substances release into the river, in the absence of a timely response, the number of affected people may be noticeably greater, hence the main emphasis is measuring precisely these parameters.

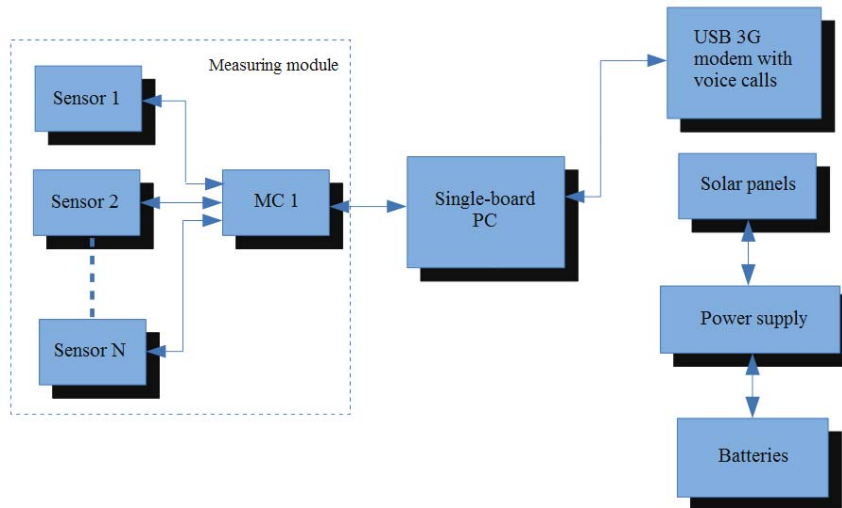


Fig. 1. Structural diagram of AHMES measuring station

The measuring system of the complex station AHMES will consist of several elementary measuring stations connected together on the central server, from which the already processed information would flow both to the Web-server, to inform the population about measured parameters, and to dispatching areas of the emergency services of Belarus and Ukraine.

Figure 2 shows the structural diagram of complete AHMES measuring system.

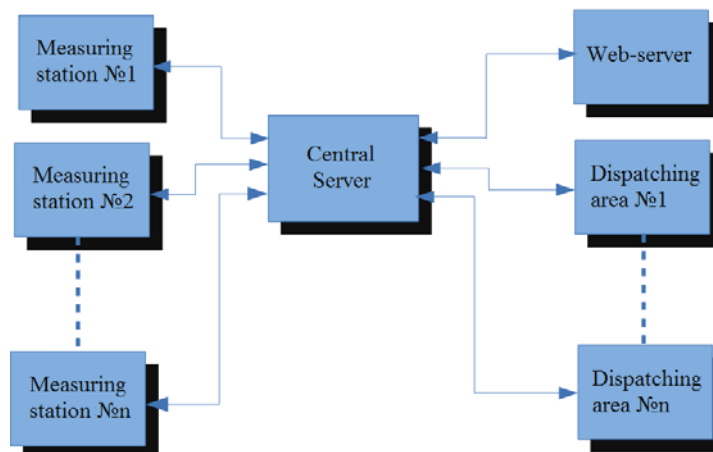


Fig. 2. Structural diagram of AHMES measuring system

In the construction of hydro-meteorological and environmental AHMES station is planned to realize the measurement of the following parameters:

- hydrology: water level and temperature;
- weather: air temperature and humidity, atmospheric pressure, wind speed and direction, rainfall;
- environmental: pH, dissolved oxygen, specific conductance, chloride ions, sulfate ions.

To measure the *water level* it is possible to use a radar level gauge or hydrostatic probe. Radar sensor require large capital costs for installation, therefore, preference is given to the hydrostatic probe (Keller Series PAA-36 X W). Estimated measuring range 0–20 m [1].

For reliable and accurate measurements of *water temperature* it is required the sensor (Vaisala QMT110) with the measuring range of $-10 - +50$ °C and accuracy of at least 0,5 °C with analog or digital output [2].

For reliable and accurate measurement of *air temperature, atmosphere pressure and humidity* it is required the sensor (Vaisala WXT534) with the digital output (RS485 interface) and the measuring ranges of:

- temperature: $-50 - +50$ °C and accuracy of at least 0,5 °C;
- atmosphere pressure: 500 – 1100 hPa (375–825 mm Hg);
- humidity: 0 – 100 % and accuracy of not less than 2 % [3].

To measure *wind speed and direction* it is required compact size combined into one unit wind speed and direction sensor (Vaisala WXT532), with the possibility of heating for work in the cold season. Wind speed measurement range up to 75 m/s.

To measure the *amount of precipitation* is expected to use a recording rain gauge (OTT Pluvio L) with a tipping bucket.

To control the *quality of water* is planned to carry out the measurement of the following main parameters in running water: pH, redox potential, chloride, nitrate;

To collect data from sensors and *data transmission* via GSM / GPRS modem is required.

In order to use *renewable energy sources*, the AHMES station will be powered by a 36 W rechargeable battery recharging by a solar panel.

The data of the main meteorological values will be recorder every 10-minute intervals, which end at 21, 00, 03, 06, 09, 12, 15, 18 h UTC [4].

Conclusion

1. As a result of the project implementation two AHMES automated hydrometeorological/environmental monitoring stations which monitor the main hydrological, meteorological and hydroecological parameters in the transboundary area of the Dnipro River will be developed, installed and tested.

2. The implementation of the project will promote awareness of citizens about international problems in the field of water resources and their impact on living conditions and economic activities in the transboundary areas of the Dnipro Basin.



The project is co-funded by
the European Union



338 Секция IV. Радиоэлектроника, автоматика, телекоммуникации, связь

List of sources used

1. Highly Precise Level Transmitters Keller Series PAA-36 X W. User manual and specifications.
2. Soil / Water Temperature Probe Vaisala QMT110. Main features, specifications and technical data.
Vaisala Weather Transmitter WXT530 Series. User manual and technical information.
3. Правила проведения приземных метеорологических наблюдений и работ на станциях : ТКП 17.10-12-2009. – Введ. 01.04.09. – Минск : Охрана окружающей среды и природопользование : Минприроды, 2009. – 182 с.