

СЕКЦИЯ 1. ИНФОРМАЦИОННЫЕ ТЕХНОЛОГИИ В ПРОИЗВОДСТВЕ И НАУКЕ

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THE CONCEPT OF BUILDING A MICROCLIMATE MONITORING SYSTEM

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Abstract. A concept has been proposed for constructing a wireless scalable indoor climate monitoring and control system based on a modern radio channel for distributed up to 2 km and underground premises. All data is automatically entered into reports, test reports, verification or calibration. Based on the concept, it is also possible to build a system for monitoring climate parameters during transportation.

Key words: microclimate, monitoring and control system, server, UniTesS Ambient software.

Introduction.

Monitoring climatic conditions is necessary during transportation, storage and testing of products that are sensitive to changes in temperature, humidity and atmospheric pressure. In this regard, automated systems for monitoring climate parameters in warehouses, hospitals, pharmacies and other premises have recently become increasingly popular [1].

Possible options for organizing the collection of sensor readings and their processing do not always take into account the specifics of product operation (number of measured parameters, room features, external conditions) and are often highly specialized systems [2] or require a subscription fee for using a cloud service [3]. The proposed concept [4] of building a system for monitoring climate conditions makes it possible to flexibly take into account the requirements of both individual users and the features of corporate operation, and does not require additional hidden costs.

The concept of organizing a monitoring system and organizing the work of UniTesS Ambient software in an enterprise network.

Figure 1 shows the placement of software elements on enterprise personal computers (PCs) in accordance with the proposed concept.

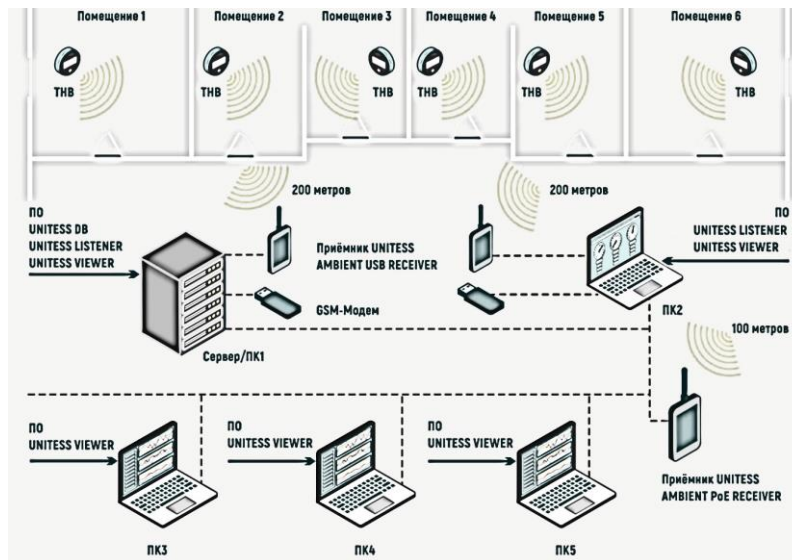


Figure 1 – Placement of software elements on an enterprise PC

A brief version of the construction and operation of the system can be presented as follows.

Thermohygrometers-barometers (THB) are located in rooms where it is necessary to measure temperature, humidity, and pressure.

A program that collects sensor readings, Ambient Listener, and a database (DB) are installed on the server/computer.

The UnitesS Receiver is connected to the server/computer via a USB port or LAN.

The UniTesS Ambient Receiver can be connected to the system either via a USB port or via an Ethernet connection.

Power is supplied exclusively via Power over Ethernet technology, i. e. over twisted pair.

The parameters for interaction with sensors, their number, etc. are the same as for the UniTesS Ambient Receiver with a USB connection. The cable length between the UniTesS Ambient Receiver and the router is no more than 100 meters (the general limit for twisted pair).

Thermohygrometers-barometers measure temperature/humidity/pressure at a given interval and transmit it to the receiver via radio channel.

The receiver receives information from thermohygrometers-barometers, transmits it to the Ambient Listener, which records data on the measured parameters in the database.

If there is no connection with the server, the receiver stores the collected data in its internal memory and sends it to the server after the connection is restored.

All information is displayed in the Ambient Viewer program, which reads it from the database. From any PC on the network, you can see the latest measured values, upload values for any period, configure device parameters via USB, LAN or radio. The system provides continuous monitoring and recording of environmental conditions in all areas where measurements/tests are carried out.

An example of a report is shown in Figure 2.

Имя	Дата	Т, °С	Т (Нижний предел), °С	Т (Верхний предел), °С	Н, %	Н (Нижний предел), %	Н (Верхний предел), %	Р, кПа	Р (Нижний предел), кПа	Р (Верхний предел), кПа
tes13	17.10.2022 17:23:14	20.100	15.000	25.000	48.600	10.000	100.000	99.800	79.000	121.000
tes16	17.10.2022 17:23:54	20.100	15.000	25.000	48.600	10.000	100.000	99.800	79.000	121.000
tes20	17.10.2022 17:24:24	20.100	15.000	25.000	48.600	10.000	100.000	99.800	79.000	121.000
tes21	17.10.2022 17:25:16	20.100	15.000	25.000	48.600	10.000	100.000	99.800	79.000	121.000

Figure 2 – Example of part of a climate monitoring report

Let's consider a detailed version of the operation of the climate monitoring system.

Thermohygrometers/thermometers (THM) are placed at control points in the premises of the enterprise.

Number of TV channels configured for one radio channel:

- minimum: 1 TNV;
- maximum: depends on the specified frequency of TNV output for communication with the UniTesS Ambient Receiver and is approximately 100 THB with a 10-minute period for TNV to communicate.

Software (UniTesS Ambient software) is installed on the enterprise Server or PC:

- database (DB) UniTesS DB;
- database server components;
- Ambient Listener utility;
- Ambient Viewer monitoring program;
- drivers for connected devices (UniTesS Ambient Receiver and GSM Modem).

The following are connected to the Enterprise Server/PC via USB(LAN):

- Receiver UniTesS Ambient Receiver;
- GSM-Modem (if there is a need for an SMS notification about approaching critical limits for temperature, humidity, pressure and about these parameters going beyond critical limits).

Additional terms:

The server/PC should be located at a distance of no more than 200–300 meters from control points (TCP), provided there is no direct visibility; in direct visibility conditions – up to 2 km.

The measured values of temperature, humidity, pressure are transmitted from the TNV via a radio channel to the UniTesS Ambient Receiver connected to the server and are recorded in the bath database using the Ambient Listener software. From any PC located on the network with the server where the UniTesS Ambient Receiver is installed, access to the database and work with the Ambient Viewer program is provided.

According to ISO/IEC 17025-2019, testing and calibration laboratories must ensure continuous monitoring and recording of environmental conditions in all areas where measurements are carried out.

To implement this requirement, most laboratories use a log of environmental conditions, and also indicate the values of humidity, temperature and pressure in the protocols.

During the annual inspection control by the laboratory accreditation body, significant discrepancies in the correspondence of values from protocols and log books are often identified.

The UNITESS AMBIENT system provides automatic generation of an electronic “Logbook of measurement conditions” in accordance with ISO/IEC 17025.

Conclusion.

The proposed concept for constructing a system for monitoring climatic conditions has been successfully implemented by the Unites enterprise at many facilities in the CIS countries, both in a stationary form and in transport [4]. UniTesS Ambient settings are extremely simple and informative – any user can master them. The web version allows an employee to see the situation at all company facilities (current indicators, alarms and graphs) on a device with any OS. UniTesS Ambient implements a flexible access distribution system. For example, one employee can be given access only to his own sensors and only for viewing, while another can have access to all enterprise objects and change their settings. At the same time, all login attempts, settings changes, and logouts are logged. Thus, UniTesS Ambient products meet the requirements of the following standards:

GDP / GMP – the system was developed taking into account these requirements (Decision No. 80 of November 3, 2016 “On approval of the rules of good distribution practice within the framework of the Eurasian Economic Union”).

ISO 17025 – automatic generation of an electronic Logbook for recording measurement conditions in accordance with ISO/IEC 17025.

21CFR PART11

GAMP 5 Guide: Compliant GxP Computerized Systems.

The UniTesS Ambient system can be validated and is optimally suited for monitoring the microclimate of warehouses, cold storage plants, various laboratories, for transporting perishable products, etc. The products of the Unites enterprise are included in the State Register of Measuring Instruments of the Republic of Belarus, the Russian Federation, and Kazakhstan, which significantly simplifies periodic verification.

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