THE CONTROL AND DATA TRANSFER SYSTEM OF THE AUTOMATED HYDROMETEOROLOGICAL / ENVIRONMENTAL STATION OF THE THEOREMS-DNIPRO INTERNATIONAL PROJECT

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Starting from November 30, 2017, by the First Program of territorial cooperation for the countries of the Eastern Partnership «Belarus–Ukraine», which is funded by the European Union, a project «THEOREMS-Dnipro» (Transboundary HydrometEORological and Environmental Monitoring System of Dnipro river) is developing. The main result of the project should be to improve the efficiency of the management of transboundary water resources of the Dnipro river.

Overall objective of project is increasing the efficiency of the integrated management of transboundary water resources of Dnipro River.

Specific objectives of project:

1. Improving the efficiency of the monitoring system of hydro-meteorological and environmental parameters of transboundary water resources of Dnipro River Basin.

2. Expansion of cooperation between Ukraine and the Republic of Belarus organizations, that control and share the information of hydro-meteorological and environmental conditions of transboundary water resources.

3. Raising public awareness and understanding of international water resources problems in transboundary areas of Dnipro Basin.

The project provides for development and implementation of two unified Automated HydroMeteorological / Ecological Station (AHMES) with wireless connection to the web-server, PV power supply and alarm system for target group information, creation Web-page and Web-application with interstate database for hydro-meteorological and environmental parameters of river. AHMES stations will include the necessary set of measuring, information and telecommunication facilities and work with the use of natural energy sources. Under the terms of the project, AHMES stations should be place at the sites of long-term hydrological observations of the transboundary zone of the Dnipro River. At the moment such places are: on the Belarusian side the Loyew hydropost, on the Ukrainian side – the Lyubech hydrogpost.

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.

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.

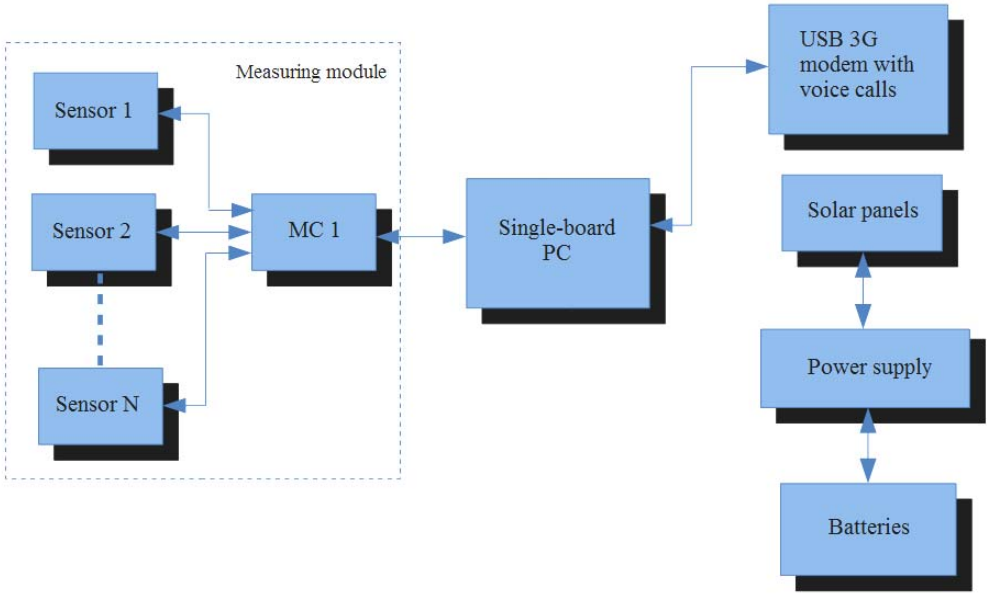

Fig. 1. Structural diagram of AHMES measuring station

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.

To collect data from sensors and data transmission via GSM / GPRS modem is required Single-Board Computer with analog inputs and RS485 modules. One of the most suitable variants of a Single-Board Computer for solving this problem is SBC35-C398 – Single-Core ARM® Industrial Computer with NXP's i.MX 6 Processor [1].

The WinSystems SBC35-C398 Single Board Computer (SBC) enables customers to use the full capabilities of the NXP i.MX6 CPU, which WinSystems has integrated into a compact, rugged, industrial form factor. This design features the following:

• High-Performance Computer: With Single, Dual, or Quad core ARM Cortex A9 options, the SBC35-C398Q product family provides a performance, scalable, multi-core platform.

• Multiple Displays with video acceleration: Supporting from two to four active displays, Camera, MIPI capture and display, and power efficient accelerators for 2D, 3D, HD Video, and multimedia applications.

• Robust I/O Platform: Each system supports the full range of available integrated I/O, including Storage, Networking, GPIO, COM, CAN, I2C, SPI, WDT, RTC, and MiniPCIe expansion.

• Reliable in extreme environments: WinSystems specifically designed the SBC35-C398 family for the rugged and wide operating range required of modern Industry. Passive Cooling operation from –40 °C to +85 °C and a wide power input range of + 10VDC to +50VDC.

Figures 2 and 3 show the location of the information connectors SBC35-C398Q, and in Table 1 – a list of its main characteristics.

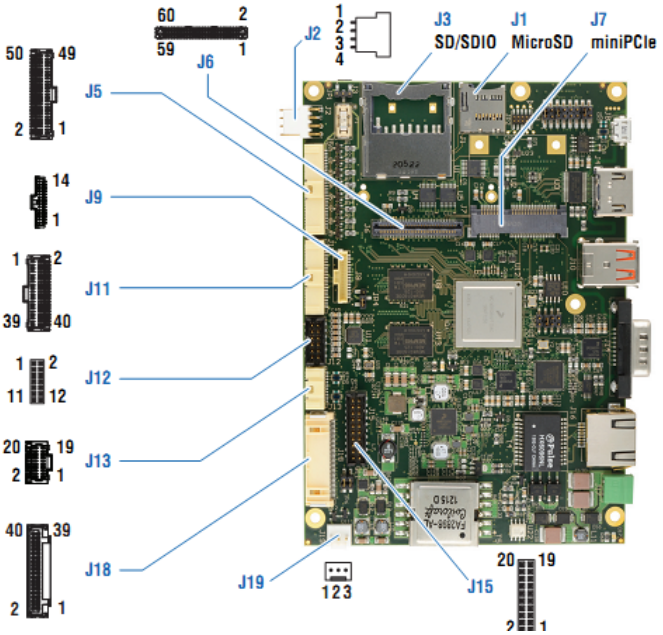

Fig. 2. SBC35-C398 Top View Connections: J1 – Micro SD; J2 – Power Controls; J3 – SD/SDIO; J5 – GPIO; J6 IO60 Expansion Bus; J7 – MiniPCIe (SBC35-C398DL and SBC35-C398Q Only); J9 – Backlight Power; J11 – LVDS; J12 – Analog Audio; J13 – Four USB Ports (SBC35-C398DL and SBC35-C398Q Only); J15 – Controller Area Network (CAN) BUS Connector (SBC35-C398DL and SBC35-C398Q Only); J18 – COM 2, 3, 4, & 5 (SBC35-C398Q Only); J19 – External Battery Connection

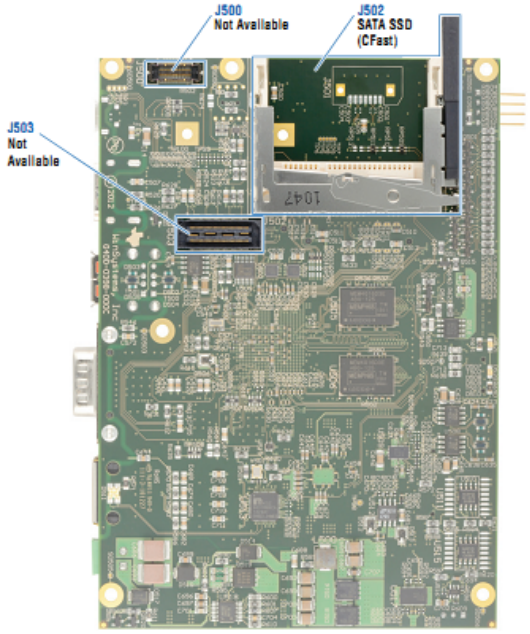

Fig. 3. SBC35-C398 Bottom View Connections: J500 – Not Available; J502 – SATA SSD (CFast)(SBC35-C398Q Only); J503 – Not Available

Table 1

List of its main characteristics of SBC35-C398Q-2-0

Processor Cores Frequency Cache	NXP i.MX 6Q 4x ARM Cortex A9 800MHz 32KB/32KB L1, 1MB L2	Audio Interfaces	HDMI + Line In/Out, Mic, Head
Memory Embedded SRAM	2GB 64bit DDR3 256KB	General Purpose I/O	24 Lines Tolerant to 30V
Hardware Display Accelerators 3D Graphics Core 2D Graphics Core Vector Graphics Core	NEON Media Processor Engine Open GL ES 3.0, Open CL Dual BitBlt OpenVG 1.1	Mass Storage	CFast + SD/SDIO + MicroSD
Video Interfaces HDMI 1.4 Type A LVDS Interface MIPI/DSI	Up to Four Active Displays HD1080p60 2x (2048x1536) or 2x (1280x720) Capture + Display	Expansion Bus Connectors Mini PCIe IO60	One Half Size I2C, SPI, TTL & PWM
MIPI	Display Port + Camera Input	Operating Temperature	–40 °C to +85 °C
Camera Interface	CMOS 8 bit	Timers	Three
Ethernet	1 Gbps Wake on LAN (WOL) IEEE 1588	Real Time Clock	Secure RTC
Serial RS 232/422/485 RS 422/485	 2x up to 1 Mbps 3x up to 5 Mbps	Battery	Optional External
CAN Ports	Two	Watchdog Timer	Programmable + TrustZone
USB Ports with Over Current Protection	6x USB 2.0 + On The Go	Electrical PoE PD Aux. Input Mechanical Dimensions Weight PC Board Thickness	 IEEE802.3at 10–50VDC 102 x 146 mm 142.2 gm 0.078"

The project is cofunded by the European Union

List of sources used

1. SBC35-C398. Single-Core ARM® Industrial Computer with NXP's i.MX 6 Processor. – Product Manual. – 51 p.