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Intelligent Supersensory Computer Network for Measurement and Analysis of Environmental Hazards

Development of intelligent supersensory computer networks and gathering, storage and data processing systems with a considerable number of the sensors metering various environmental hazards which can be a danger to human health and biosphere are considered. The construction of a system prototype which includes directly the supersensory data collection system and client-server architecture is offered. Also questions of a data analysis using complex indexes are considered.

Keywords: Sensor network, supersensory computer, intelligent supersensory computer network, environmental hazard, client-server architecture, analog-to-digital converter, microcontroller, sensor, digital interface, communication protocol, complex index

Introduction

One of actual problems of the modern world today is environment pollution by the factors which are a result of human activity and the measurement of these pollutions. Such factors may include acoustic noise, vibration, electromagnetic radiation, ionizing radiation, toxic gas emissions, biological pollution, effects on weather and climate. For measurement of some parameters bulky expensive devices are required. Many parameters are measured separately and frequently complex estimations of influence of these parameters on environment are not carried out and correlations between them are not investigated.

The purpose of this work is to describe the possible ways of solving the problems described above.

The main idea of this work is creating a universal supersensory computer and building a network of these devices for data analysis, prediction and conclusions about the suitability of the environment for humans and other living organisms.

The relevance of tasks in view proves to be true as daily we are exposed to the influence of external factors of environment and we do not have have a slightest notion about the influence of these factors on our organism.

Scientific novelty of the paper is that the developed system will analyze in a complex arriving data from multiple sensors, find correlations between them, make an estimation of the influence of environmental factors on the human body, besides it is mobile and cheap as compared to modern mobile devices, such as smartphones, PDA or satellite navigators.

Intelligent Supersensory Computer Networks

Sensor network is a distributed adaptive wireless network of small intelligent sensor devices. Intelligent sensor networks are aimed at collecting, processing and transmission of information with high demands for autonomy, reliability, scalability, and distributivity of network.

The main applications of intelligent sensor networks include the following branches of research and production:

- Security systems and access control
- Building Automation
- Diagnostics of industrial equipment
- Remote collection of readings from meters
- Telemedicine and Health
- Military applications
- Environmental Monitoring

The author develops such network architecture, called *Intelligent supersensory computer network*, that will be able to combine a lot of so-called supersensory computers that will accomplish the following:

1. Accumulation and storage of information from handheld supersensory computers.
2. Analysis of the recorded data, finding correlations between them.
3. Visualization of the information with the use of GIS technologies.
4. Forecasting future changes of the measured parameters and their impact on the environment.

5. Formation of conclusions about suitability of environment for human health and biosphere.

Supersensory computer is an intelligent sensor device, which includes a large number of tiny sensors, microprocessor, memory, and communication. Intelligence of a supersensory computer is available in the microprocessor programmed by special algorithms to analyze the measured parameters.

Nowadays for the development of intelligent sensor networks two most common architectures are used: client-server and peer-to-peer architectures. The use of client-server architecture in which portable supersensory computers will be clients is presupposed. Information from them will come to a central server [1, 2, 5-18, 27, 31-34, 36, 37]. Figure 1 shows the block diagram of client-server architecture of intelligent supersensory computer network.

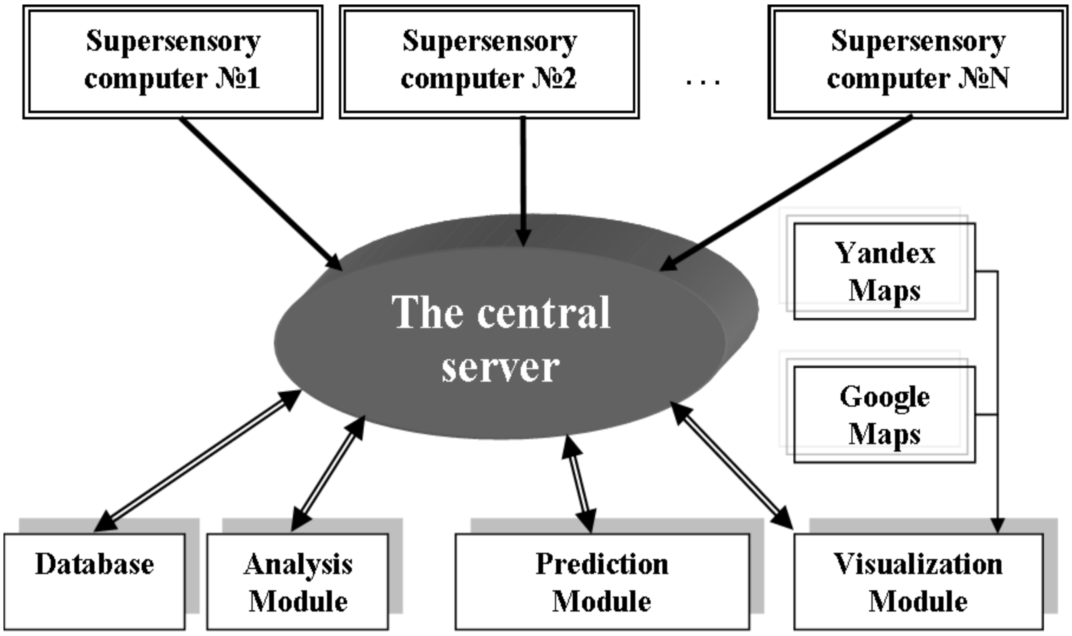

Figure 1 – A structural block diagram of intelligent supersensory computer network

Hardware architecture of supersensory computer

Supersensory computer consists of the following modules (simple modular architecture that allows quickly replacing any of the modules or sensors is used):

1. Micro Controller Unit (MCU)
2. Analog-to-Digital Converter (ADC)
3. Impulse-to-Digital Converter (IDC)
4. Frequency-to-Digital Converter (FDC)
5. Connection Module (CM)
6. Memory Module (MM)
7. Power Module (PM)
8. Real Time Clock (RTC)
9. Navigation Module (NM)
10. Analog Sensors (AS)
11. Digital Sensors (DS)
12. Impulse Sensors (IS)
13. Input Devices (ID)
14. Output Devices (OD)

Figure 2 shows a block diagram of supersensory computer.

Micro Controller Unit (MCU) is the main device, without which supersensory computer can not function. MCU consists of a microprocessor, a clock circuit and additional items. The microprocessor is a chip that includes a memory, an arithmetic logic unit (ALU), the control unit (CU), the data bus, and so on, that is the basic building blocks that are a part of common processors. If the microprocessor also contains modules ADC, IDC, FDC, RTC, CM, MM and NM it's already called a microcontroller. The clock scheme sets a clock speed of the processor; the additional elements determine the proper functioning of the processor.

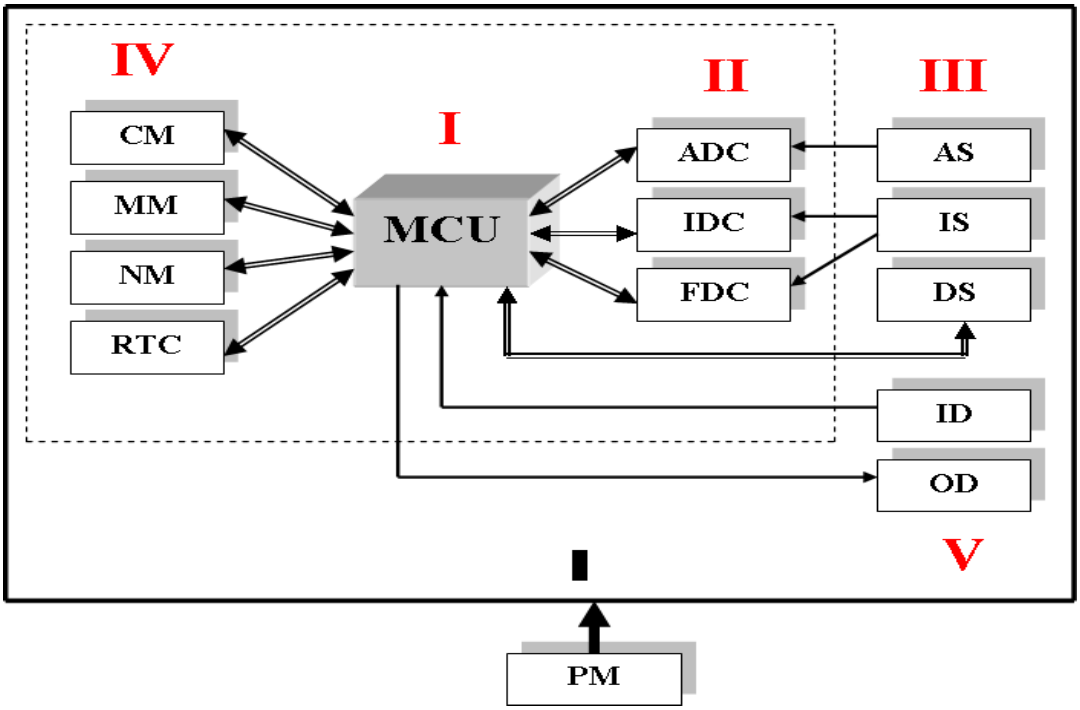

Figure 2 – Block flow diagram of supersensory computer

MCU module performs the following functions:

1. Controls the operation of peripheral devices - modules ADC, IDC, FDC, RTC, CM, MM, NM, PM, ID and OD.
2. Performs mathematical processing of the measurements from the sensors.
3. Outputs the data to the output devices (OD) and transmit them through a module CM to external devices for storing and processing.

Signal conversion modules (ADC, IDC, FDC) are required to convert signals from analog to digital form, clear for the microprocessor. Most analog sensors have an output signal with voltage directly proportional to the measured value, such as temperature, humidity, pressure. To work with them requires an analog-to-digital converter (ADC). The developed device has a built-in microcontroller, 10-bit ADC. Also, an external 24-bit sigma-delta ADC with integrated digital filter is used for very accurate measuring. Some sensors such as anemometers, Geiger's counters output pulses. To measure the pulse frequency – frequency converters (IDC, FDC) are used. But, as a rule, the are no longer necessary when using modern and fast microcontrollers.

Connection module (CM) - provides data exchange between supersensory computer and any other device that can store and process information. This could be a mobile phone, a personal computer, a centralized server, and so on. As interfaces can be used wired (LPT, RS-232, RS-485, USB, FireWire, Ethernet), and wireless (IrDA, Bluetooth, Wi-Fi, GSM) communication interfaces. First experimental devices use an USB interface.

Memory Module (MM) consists of the internal and external memory. It is used for storing the information obtained from the sensors to be processed. As a non-volatile internal memory, memory of the microcontroller is used, memory cards can be used as external, USB-drives and hard disk drives (HDD).

Real-time clock (RTC) is needed for accurate time measurement of recording information from sensors. RTC module is synchronized with the atomic clock installed on the navigation satellites through GPS module.

Navigation module (NM, GPS) determines the geographical location of supersensory computer. This is necessary for the subsequent analysis of data sensors, focused on particular geographic coordinates and object definitions that create a negative impact on the environment.

Power Module (PM) provides a stable power supply by different voltages of all modules of supersensory computer, monitors battery charge and protects chips from interference and harmful impulses.

Input/Output device information (ID/OD) are buttons, keyboard, controllers, display, LEDs and sound indicators, printers, needed to control a supersensory computer and display the value of the measured parameters [3-5, 7, 11, 12, 14, 18-22, 24-27, 33, 35].

Main parameters of supersensory computer

Universality, the presence of a different digital interfaces and ADC allows connecting both analog and digital sensors, which measure various parameters of the environment and have different accuracy and precision of measurements. The modular design (Figure 1) of the device makes it easy to replace the sensors. Table 1 shows the main parameters that will be measured using supersensory computer.

Table 1 – Main parameters measured by supersensory computer

Instrument parameter	Measuring range	Error
Temperature	-55…+125 °C	±0.5 %
Relative humidity	0...100 %	±2 %
Atmospheric pressure	300…1100 hPa	±0.1 %
Illuminance	0…70000 Lux	±10 %
Mechanical vibrations	-16…+16 g (3 axes)	±2 %
The acoustic noise	0…150 dB	±10 %
Ionising radiation	0...100000 mR/h	±10 %
Magnetic field	0...1000 Gauss	±1.5%
Electromagnetic radiation	0…4000 mW/cm^2	±10 %
Lightning detector	0…100 km	±50 %
Concentration of ozone	0.01...1 ppm	±50 %
Concentration of carbon monoxide	1…1000 ppm	±50 %
Concentration of ammonia	0.1…100 ppm	±50 %
Concentration of nitrogen dioxide	0.05…5 ppm	±50 %
The general concentration of harmful gases and steams	0…1000 ppm	±50 %
Electronic compass	0…360 ° (3 axes)	±1 %
Navigation	GPS, GLONASS	*****

Also supersensory computer will include the following components and devices:

- Satellite navigation receiver GPS / GLONASS
- Wireless modem with GSM / GPRS standards
- MicroSD card reader
- Built-in battery
- USB interface
- Bluetooth

Sensors

The sensor is an electronic device used for the detection or measurement of physical quantities and convert them into an electronic signal. In other words, the sensors are devices that convert aspects of physical reality in view, understandable to computers.

The sensors have the following characteristics:

- *Transfer function* is the relationship between the physical input signal and electrical signal at the output.
- *Hysteresis* is the response time rate of the change of the sensor output, depending on the rate of the change of the input signal.
- *Linearity* shows how the sensor output signal is different from the ideal in the whole measurement range of input signal.
- *Sensitivity* is the relationship between a small change in the input signal and the final output signal.
- *Accuracy* shows the maximum possible error between the ideal and the real outputs.
- *Dynamic range* the range of input signals, which can be accurately converted into electrical output signals.
- *Noise level* characteristics that shows the amount of noise, which is added to the sensor output.
- *Sensor resolution* is minimal changes of the input signal that the sensor can detect.
- *Bandwidth* determines the number of measurements, which can be performed by a sensor per a unit of time, or conversion frequency.

There are two ways to classify sensors: the first is based on the principles, on which they operate, the second is based on the functions they perform. Firstly, they can be classified by physical parameters measured by them:

- Mechanical
- Thermal
- Electrical
- Magnetic
- Radiation
- Chemical
- Biological

According to the type of sensor output they can be divided into analog, digital and impulse ones.

Analog sensors, for example, are temperature, humidity, pressure, acoustic, gas sensors, thermocouples, photoelectric sensors, etc. Supersensory computer contains two independent ADCs with different resolutions, processing speed and the presence of built-in filters and amplifiers, and therefore allows connecting any of these sensors.

Impulse sensors are wind speed sensors, flowmeters, ionize particle counters and dust meters. They are connected to the MCU module directly or through a matching device .

Digital sensors are components that already contain an analog sensor, amplifier, filter, ADC, microcontroller, memory, registers and a digital interface that is compatible with microcontrollers.

Now sensors with digital interface become widespread, since they do not require an external ADC conversion devices [4, 5, 7, 12, 14, 17].

Digital interfaces of sensors

Today the most common are one-, two-, three-and four-wire serial digital interfaces. They are divided into synchronous and asynchronous. These include, for example, RS-232, RS-485, USB, CAN, 1-wire, SPI, I^2C, etc. Digital sensors mainly use 1-wire, SPI and I^2C interfaces.

1-Wire is bidirectional communication for devices with low-speed data transmission (commonly 15.4 kbit/s, a maximum of 125 kbit/s in overdrive), in which both data and power are transmitted on the same line (there are two wires - one for ground and the other for power and data, and in some cases a separate power cord is used). It is developed by Dallas Semiconductor and it is a registered trademark. Accordingly, the topology of such a network is a common bus. Network of 1-Wire devices with an associated primary device is called "MicroLan", it is also a trademark of Dallas Semiconductor. Typically it is used to communicate with inexpensive simple devices, such as, for example, digital thermometers. Figure 3 shows a diagram of the connection of 1-Wire devices to the microcontroller [38].

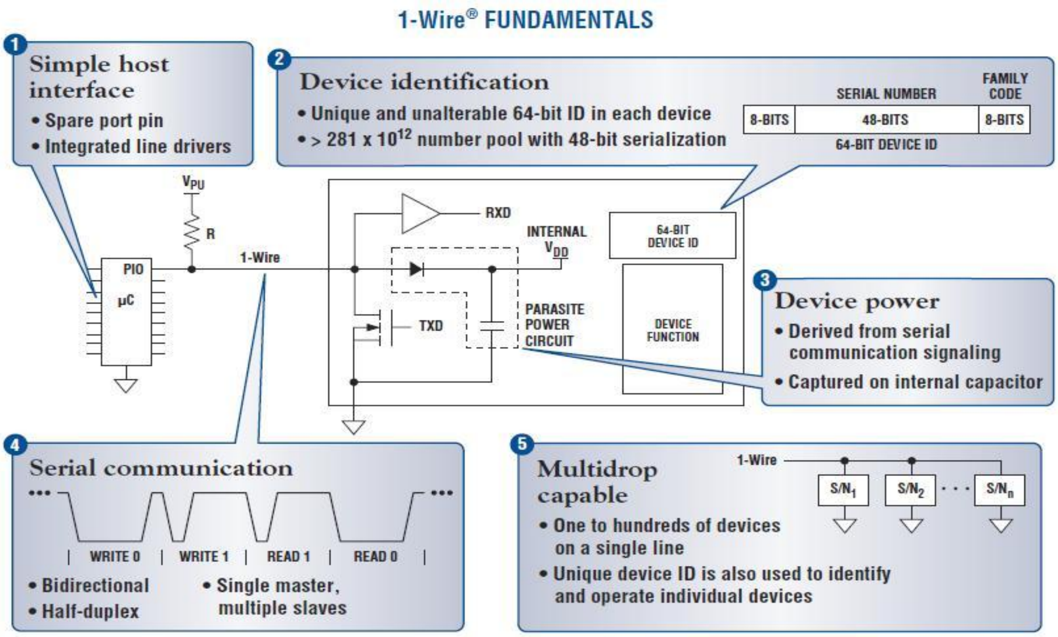

Figure 3 – Wiring 1-Wire devices to the microcontroller [38]

I²C is a serial data bus for communication of integrated circuits, developed by Philips in the early 1980s as a simple intercom bus to create control electronics. It is used to connect the low-speed peripheral components to the motherboard, embedded systems and mobile phones. The name is an abbreviation of the words Inter-Integrated Circuit. I²C uses two bidirectional lines, pulled up to the supply voltage and managed through an open collector or open drain – Serial Data Line (SDA, Serial DAta) and Serial Clock Line (SCL, Serial CLock). Standard +5 V or +3.3 V, but others are allowed. Classical addressing in bus includes 7-bit address space with 16 reserved addresses. Figure 4 shows the circuit connection of devices using bus I²C [39].

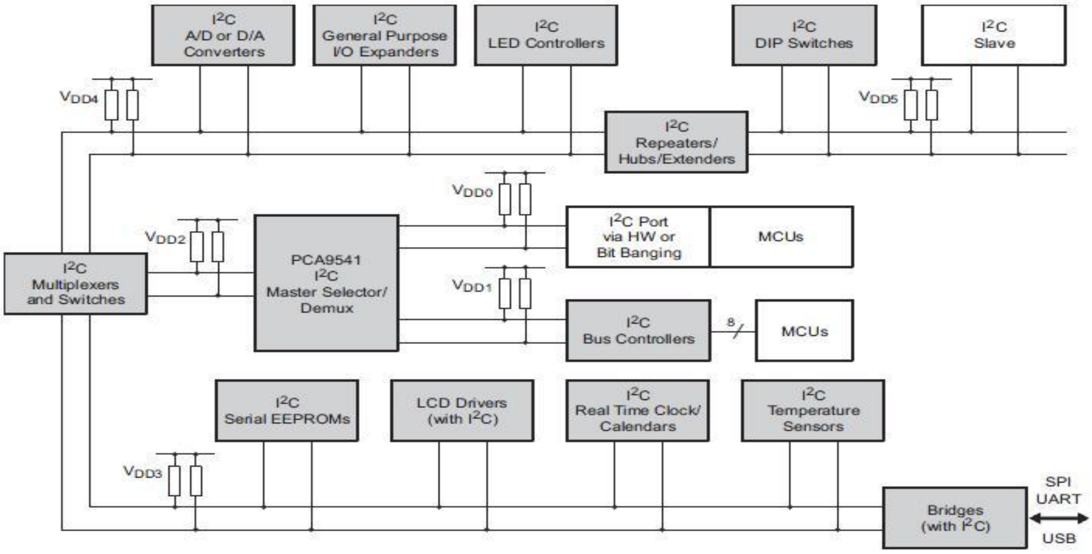

Figure 4 – Diagram of connecting devices to the I^2C bus [39]

SPI is serial synchronous full-duplex data transfer standard, developed by Motorola to provide a simple and inexpensive connection of microcontrollers and peripherals. SPI is also sometimes referred to as a four-wire interface. In contrast to the standard serial port, SPI is a synchronous interface, in which any transfer is synchronized with a common clock signal generated by the master unit (CPU). Host (slave) peripherals synchronize getting bit sequence with the clock signal. Master chip can join one serial peripheral interface. The master selects the slave for the transfer, triggering "chip select" (CS) signal on the remote chip. Periphery, not chosen by the processor, does not participate in the transfer on SPI. SPI uses four digital signals:

- SCLK: serial clock (output from master);
- MOSI: master output, slave input (output from master);
- MISO: master input, slave output (output from slave);
- SS: slave select (active low, output from master).

Figure 5 shows a diagram of several devices connected to the microcontroller via interface SPI [4].

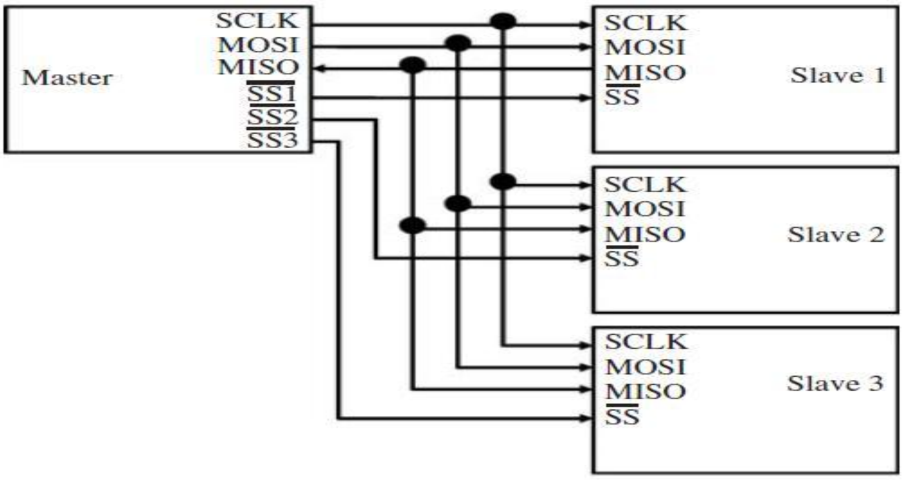

Figure 5 – Diagram of several devices connected to the microcontroller via interface SPI [4]

The developed supersensory computer supports both parallel communication with the sensor, and synchronous and asynchronous serial interfaces [4, 23].

Complex parameters and indexes

Now to estimate the influence of external environment factors on the human, complex indexes, which simultaneously consider some parameters, are used. These indexes are commonly used in weather stations, which use several parameters (temperature, humidity, wind speed, etc.) to estimate the ambient temperature actually felt with people's skin, which is different from that shown by thermometers.

These indexes, for example, are [29, 30]:

- ✓ Heat Index (humiture) - considers the relative humidity and temperature
- ✓ Humidex – considers temperature, humidity, a dew-point
- ✓ Wind Chill - considers temperature and wind speed
- ✓ Wet-Bulb Globe Temperature (WBGT) - the complex index, which considers also radiating and convective heat transfer, but also air humidity
- ✓ THC index - is an empirical measure of the combined effect on the human microclimate parameters (temperature, humidity, air velocity and thermal radiation).

Let's consider, for example, the Heat index. It is calculated only by the two characteristics - temperature and relative humidity, because humidity affects the secretion of sweat from the skin, and thus the entire heat transfer in general. Equation (1) of Heat index calculation is as follows [28]:

$$\begin{gathered} HI = c_1 + c_2T + c_3R + c_4TR + c_5T^2 + \\ + c_6R^2 + c_7T^2R + c_8TR^2 + c_9T^2R^2 \\ c_1 = -42.379, \quad c_2 = 2.04901523, \\ c_3 = 10.14333127, \quad c_4 = -0.22475541, \\ c_5 = -6.83783\times10^{-3}, \; c_6 = -5.481717\times10^{-2}, \\ c_7 = 1.22874\times10^{-3}, \quad c_8 = 8.5282\times10^{-4}, \\ c_9 = -1.99\times10^{-6} \end{gathered} \tag{1}$$

It is proposed to introduce the so-called general hazard index that takes into account not only the atmospheric parameters, but also ionizing, electromagnetic influence, acoustic noise, vibration and air pollution.

For example, everyone knows that noise negatively influences a person's working capacity, but together with higher temperature and subsonic noise frequency this may lead to the complete loss of working capacity and affect a person's mental state.

Conclusions

In this paper the basic principles of developing supersensory computers, intelligent supersensory computer networks and computing the values of the complex indexes were described. It is possible to draw the following conclusions:

1. Modularity, easy use, the ability of replacing individual units and sensors and mobility make the system accessible to a wide range of users.
2. Target price of such devices will be 100 to 1000 $, depending on the equipment that is less than the average price of mobile phones and GPS.

Experimental model of supersensory computer with eight measures of environmental parameters and USB-connection to PC was developed. In the future it is planned to solve following problems:

1. Development of some experimental devices.
2. Development of low-cost, compact supersensory computer, equipped with the maximum number of sensors.
3. Studying the combined effect of various parameters on the human body and the development of mathematical models.
4. Developing the software for the central server, which will be able to collect and analyze information received from devices in real time.

References

1. Akyildiz I. F. Wireless Sensor Networks / Akyildiz I. F., Vuran M. C. – Chichester: John Wiley & Sons Ltd., 2010. – 493 p.
2. Bulusu N. Wireless Sensor Networks / Bulusu N., Jha S. – Norwood: ARTECH HOUSE, INC, 2005. – 344 p.
3. Clements A. The Principles of Computer Hardware / Clements A. – Oxford: Oxford University Press, 2000. – 716 p.
4. Dargie W. Fundamentals of wireless sensor networks. Theory and practice / Dargie W., Poellabauer C. – Chichester: John Wiley & Sons Ltd., 2010. – 311 p.
5. Dishongh T. J. Wireless Sensor Networks for Healthcare Applications / Dishongh T. J., McGrath M. – Norwood: Artech House, 2010. – 246 p.
6. Fekete S. P. Algorithmic Aspects of Wireless Sensor Networks / Fekete S. P. – Berlin: Springer-Verlag Berlin Heidelberg, 2008. – 150 p.

7. Application and Multidisciplinary Aspects of Wireless Sensor Networks. Concepts, Integration, and Case Studies / Gavrilovska L., Krco S., Milutinovic V., et al. – London: Springer-Verlag London Limited, 2011. – 282 p.

8. Hara T. Wireless Sensor Network Technologies for the Information Explosion Era / Hara T., Zadorozhny V. I., Buchmann E. – Berlin: Springer-Verlag Berlin Heidelberg, 2010 – 272 p.

9. Jurdak R. Wireless Ad Hoc and Sensor Networks: A Cross-Layer Design Perspective / Jurdak R. – New York: Springer Science+Business Media, LLC, 2007. – 264 p.

10. Lopez J. Wireless Sensor Network Security / Lopez J., Zhou J. – Amsterdam: IOS Press, 2008. – Vol. 1. – 313 p.

11. Marron P. J., Voigt T., Corke P., Mottola L. // Real-World Wireless Sensor Networks. 4th InternationalWorkshop, REALWSN 2010. Colombo, Sri Lanka, December 16-17, 2010. – Berlin: Springer-Verlag Berlin Heidelberg, 2010. – 208 p.

12. Mukhopadhyay S. C. Advances in Wireless Sensors and Sensor Networks / Mukhopadhyay S. C., Leung H. – Berlin: Springer-Verlag Berlin Heidelberg, 2010. – 360 p.

13. Raghavendra C. S. Wireless Sensor Networks / Raghavendra C. S., Sivalingam K. M., Znati T. – Boston: Kluwer Academic Publishers, 2004. – 426 p.

14. Roedig U., Sreenan C. J. // Wireless Sensor Networks. 6th European Conference, EWSN 2009. Cork, Ireland, February 11-13, 2009. – Berlin: Springer-Verlag Berlin Heidelberg, 2009. – 375 p.

15. Serpedin E. Synchronization in Wireless Sensor Networks: Parameter Estimation, Performance Benchmarks and Protocols / Serpedin E., Chaudhari Q. M. – New York: Cambridge University Press, 2009. – 232 p.

16. Silva J. S., Krishnamachari B., Boavida F. // Wireless Sensor Networks. 7th European Conference, EWSN 2010. Coimbra, Portugal, February 17-19, 2010. – Berlin: Springer-Verlag Berlin Heidelberg, 2010 – 339 p.

17. Observing Systems for Atmospheric Composition. Satellite, Aircraft, Sensor Web and Ground-Based Observational Methods and Strategies / Visconti G., Carlo P. D., Brune W. H., et al. – New York: Springer Science+Business Media, LLC, 2007. – 244 p.

18. Zhang Y. RFID and Sensor Networks. Architectures, Protocols, Security and Integrations / Zhang Y., Yang L. T., Chen J. – Boca Raton: Taylor and Francis Group, LLC, 2010. – 626 p.

19. Tan W. M. Developing USB PC Peripherals / Tan W. M. – San Diego: Annabooks, 1997. – 176 p.

20. Anderson D. USB System Architecture (USB 2.0) / D. Anderson. – Monument: MindShare, Inc., 2001. – 506 p.

21. Bluetooth Application Developer's Guide: The Short Range Interconnect Solution / Kammer D., McNutt G., Senese B., Bray J. – Rockland: Syngress Publishing, Inc., 2002. – 526 p.

22. Axelson J. Embedded Ethernet and Internet Complete. Designing and Programming Small Devices for Networking / Axelson J. – Madison: Lakeview Research LLC, 2003. – 482 p.

23. Axelson J. Serial Port Complete. Programming and Circuits for RS-232 and RS-485 Links and Networks / Axelson J. – Madison: Lakeview Research LLC, 2003. – 306 p.

24. Axelson J. The Microcontroller Idea Book. Circuits, Programs, & Applications featuring the 8052-BASIC Microcontroller / Axelson J. – Madison: Lakeview Research LLC, 1997. – 278 p.

25. Jasio L. D. Programming 16-Bit PIC Microcontrollers in C / Jasio L. D. – Burlington: Elsevier Inc, 2007. – 379 p.

26. Axelson J. USB Mass Storage. Designing and Programming Devices and Embedded Hosts / Axelson J. – Madison: Lakeview Research LLC, 2006. – 287 p.

27. Anoprijenko A. Simulation Tools and Services for Mobile Users: History, State-of-the-art and Future / Anoprijenko A., John S., Al-Ababneh H. // Proceedings of the International Conference & Workshop on 3G GSM & Mobile Computing: An Emerging Growth Engine for National Development, 29-31 January, 2007. – College of Science and Technology, Covenant University, Canaan Land, Ota, Nigeria, 2007. – P. 9-20.

28. Rothfusz L. The heat index (or, more than you ever wanted to know about heat index) (Technical Attachment SR 90-23) / L. Rothfusz. – Fort Worth: Scientific Services Division, National Weather Service, 1990.

29. Epstein Y. Thermal Comfort and the Heat Stress Indices / Epstein Y., Moran D. S. – Tokyo: Industrial Health 2006, 44. – P. 388-398.

30. A signature of persistent natural thermohaline circulation cycles in observed climate / Knight J. R., Allan R. J., Folland C. K., et al. – Washington: Geophysical research letters. – 2005. – Vol. 32, l20708 – 4 p.

31. Open Sensor Web Architecture: Core Services / Chu X., Kobialka T., Durnota B., Rajkumar Buyya R. // Proceedings of the 4th International Conference on Intelligent Sensing and Information Processing 15 Dec. – 18 Dec 2006, Bangalore, 2006. – P. 98-103.

32. Delin K. A. Sensor Webs in the Wild. - Wireless Sensor Networks: A Systems Perspective. – Norwood: Artech House, 2005. – 321 p.

33. Nittel S. A Survey of Geosensor Networks: Advances in Dynamic Environmental Monitoring – Basel: Sensors Editorial Office, Sensors 2009, 9. P. 5664-5678.

34. Bröring A., Echterhoff J., Jirka S., Simonis I., Everding T., Stasch C., Liang S., Lemmens R. New Generation Sensor Web Enablement – Basel: Sensors Editorial Office, Sensors 2011, 11. P. 2652-2699.

35. Варзар Р. Л. Разработка цифро-аналогового преобразователя – звукового адаптера, работающего через последовательный порт RS-232 на базе микроконтроллера ATmega16 / Р.Л. Варзар, А.Ю. Харитонов // Информационные технологии и информационная безопасность в науке, технике и образовании – 2007. Материалы международной научно-практической конференции. – Севастополь, СевНТУ – 2007. – Ч. 2. – С. 99.

36. Варзар Р. Л. Проблемы применения беспроводных технологий для организации учебного процесса и тестирования знаний в ДонНТУ / Р. Л. Варзар, Н. Е. Губенко // Інформатика та комп'ютерні технології – 2008. Збірка матеріалів четвертої міжнародної науково-технічної конференції студентів, аспірантів та молодих вчених. – Донецьк, ДонНТУ. – 2008. – С. 55.

37. Варзар Р. Л. Разработка и применение систем беспроводной связи для измерения параметров атмосферы / Р. Л. Варзар, А. Ю. Харитонов // Комп'ютерний моніторинг та інформаційні технології – 2009. Збірка матеріалів п'ятої всеукраїнської науково-технічної конференції студентів, аспірантів та молодих науковців. – Донецьк, ДонНТУ. – 2009. – С. 124.

38. 1-Wire Products. Design Guide. 4th Edition. From Maxim Integrated. – P.1. [Электронный ресурс] – Режим доступа: http://pdfserv.maximintegrated.com/en/pg/1_WIRE_PRODUCTS.pdf

39. I2C-bus specification and user manual. From NXP Semiconductors. – P. 4. [Электронный ресурс] – http://www.nxp.com/documents/user_manual/UM10204.pdf

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Інтелектуальна суперсенсорна комп'ютерна мережа для вимірювання та аналізу небезпечних факторів навколишнього середовища

Розглядаються питання проектування інтелектуальних суперсенсорных комп'ютерних мереж та систем збору, зберігання і обробки даних з великою кількістю датчиків, що вимірюють різні параметри навколишнього середовища, які можуть становити небезпеку для життя та здоров'я людини і біосфери. Пропонується конструкція прототипу такої системи, яка включає в себе безпосередньо суперсенсорну систему збору даних і клієнт-серверну архітектуру. Також розглядаються питання аналізу даних з використанням комплексних індексів.

Ключові слова: сенсорні мережі, суперсенсорний комп'ютер, інтелектуальна суперсенсорна комп'ютерна мережа, небезпечні фактори навколишнього середовища, клієнт-серверна архітектура, аналого-цифровий перетворювач, мікроконтролер, датчик, цифровий інтерфейс, протокол зв'язку, комплексний показник

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Интеллектуальная суперсенсорная компьютерная сеть для измерения и анали за опасных факторов окружающей среды

Рассмотриваются вопросы проектирования интеллектуальных суперсенсорных компьютерных сетей и систем сбора, хранения и обработки даннях с большим количеством датчиков, измеряющих различные параметры окружающей среды, которые когут представлять опасность для жизни и здоров'я человека и биосферы. Предлагается конструкція прототипа такой системы, включающая в себя непосредственно суперсенсорную систему сбора даннях и клиент- серверную архітектуру. Также рассмотриваются вопросы анали за даннях с использованием комплексних индексов

Ключевые слова: сенсорные сети, суперсенсорный компьютер, интеллектуальная суперсенсорная компьютерная сеть, опасные факторы окружающей среды, клиент- серверная архитектура, аналого-цифровой преобразователь, микроконтроллер, датчик, цифровой интерфейс, протокол связи, комплексный показатель