Smart house.

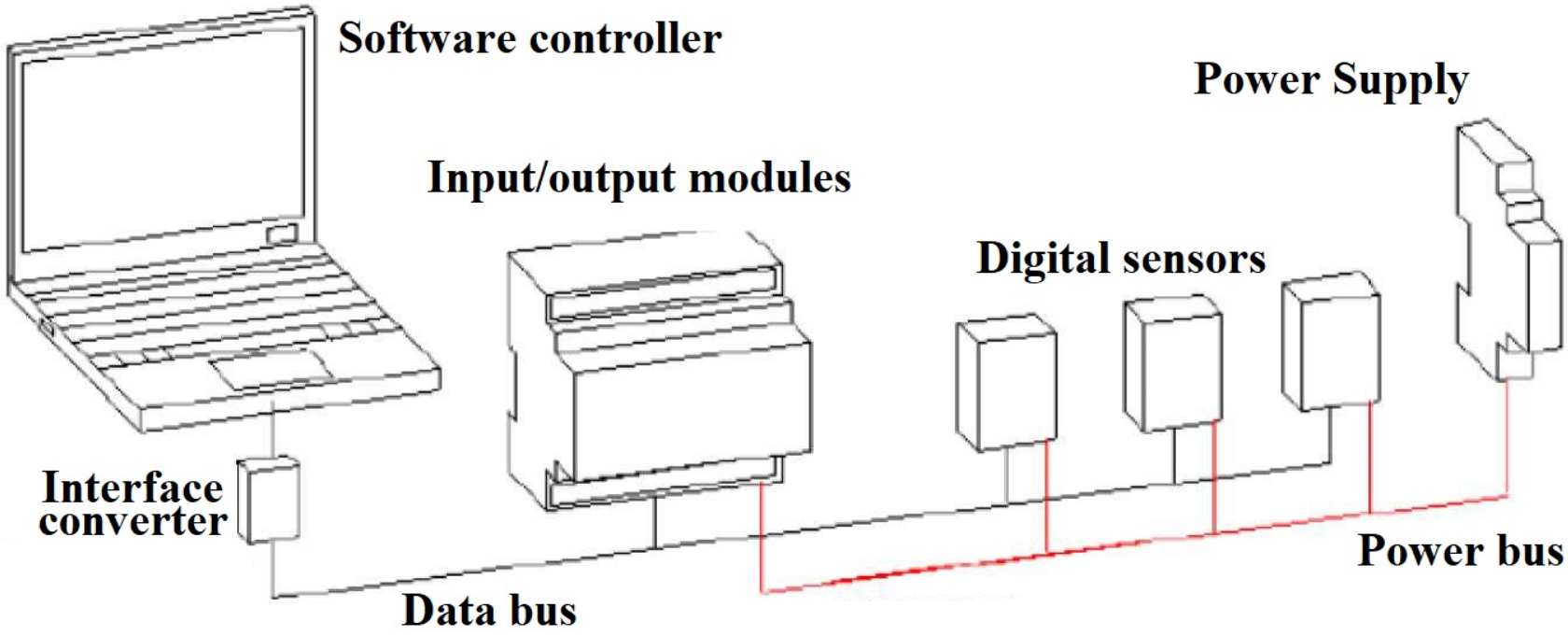
Currently, the market of "smart" houses is rapidly gaining momentum. More and more people are starting to think about installing home automation systems. This trend is due to several reasons: firstly, the improvement of the material well-being of people, and as a result, the increase in requirements for the quality of life, secondly, the reduction of the cost of automation systems, and thirdly, the economic validity of these systems.

In addition to saving energy costs and building maintenance, home automation systems can significantly increase the level of home protection against unauthorized entry by outsiders and minimize the consequences of technical accidents - gas leaks, burst heating and water supply pipes.

The use of home automation systems is fully justified and the transition to their flow installation in all newly constructed houses is a matter of time.

Let's consider one of the smart home options.

The home automation system has a modular construction principle, consisting of modules connected by a data bus. All modules are connected according to the common bus topology.



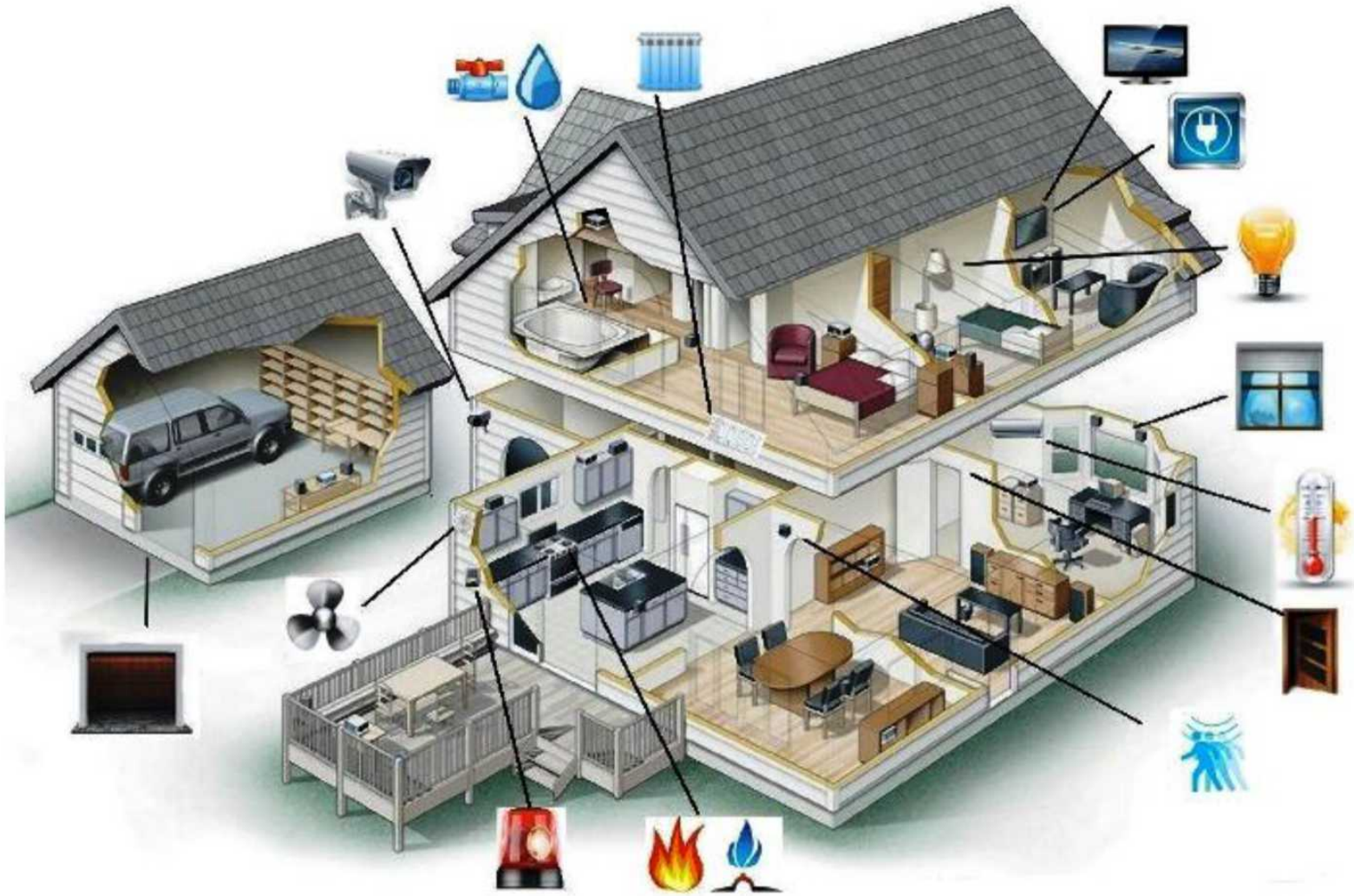
The entire system is managed by a controller that, using various modules (input-output, light, temperature, humidity, motion sensors), can interact with the outside world. The number and composition of modules is determined by the task being solved.

The controller - its task is to control all subordinate modules according to the program embedded in it.

In connection with that. that the transfer of controller data is possible only in digital form, special modules called input or input-output modules are used in the system. It is they who will receive physical signals from the sensors and transform them into a digital form understandable for the controller.

Input-output module - any sensors can be connected to its inputs.

The home automation system includes many sensors for measuring environmental characteristics. The main ones are humidity, lighting and air temperature.



History of creation and development.

The starting point of home automation was the appearance of household electrical appliances. From the beginning to the middle of the 20th century, irons were invented and implemented.

refrigerator, washing machine, etc.

One of the first projects of a smart house was the six-room house of the American engineer Emil Mathias. In 1950, the Popular Mechanics magazine published an article about him called Push-Button Manor.

The most active period of development of smart home systems came in the 2000s and 2010s, which was facilitated by the mass spread of wireless communication technologies, the appearance of smartphones and the improvement of household appliances. So, in the 2010s, such giants of the IT industry as Apple, Samsung and Amazon presented their products and platforms for the smart home, not to mention the many projects in this area from smaller companies.

The stages of development of smart houses can be divided into the following:

1. Introduction of wireless communication.

2. Implementation of artificial intelligence technologies.

3. Implementation of assistant robots.

In 1975, Scottish Pico Electronics developed the first specialized standard for controlling home devices: X10. An ordinary electrical network was used for signal transmission. In addition, the creators provided for wireless control at a radio frequency of 433 MHz (in the USA, 310 MHz). The new system made it possible to turn on and off the devices and change the brightness of the light, as well as to receive data on the current state of the devices. Special remotes and a computer interface were developed to control the X10. The widespread use of X10 systems was facilitated by their ease of installation and low price.

X10 was a fairly simple standard at the time, with only six commands to execute. The technology was mostly used for lighting control. Gradually this became not enough. The next significant stage in the history of the development of the Smart House dates back to 1992.

Already by the mid-nineties, a proprietary protocol for connecting elements of a smart home appears in Europe - it is EIB, created by the EIBA association. It includes more than 15 well-known brands. It must be admitted that both technologies, American and European, proved to be long-lived and are still used, however, with some modifications.

X10, despite its slowness and susceptibility to interference, is widely used in the automation of residential premises, although today it is already considered somewhat outdated. But EIB is used very widely. Experts consider it the main platform on which functional modern Smart homes are built. After the successful presentation of the new protocol, EIBA is rapidly increasing the production of equipment.

Smart home technologies.

There are several different communication standards or protocols that these devices use to communicate with each other and the operating controllers. Some devices are connected by a wired connection, some by wireless, some use both. and other. Be sure to check which protocol your device uses before you buy it, so that all your purchases are compatible with each other.

XI0. This is the oldest of the home automation protocols, which appeared back in the 70s of the past. Now it is used for both wired and wireless communication. X10 is not distinguished by insane speed or super-reliable communication between devices in the home automation network, nevertheless, this standard has been established for a long time and many still prefer to use XI0.

ZigBee. This is another name for the IEEE 802.15.4 wireless standard used by a group of manufacturers in the ZigBee Alliance. The main advantage of this standard is that a mesh network is created in which most devices are equal and communicate with each other on equal terms. The network offers increased reliability and resilience. When one of the nodes stops functioning, the other nodes continue to work, connecting to each other directly or through other intermediate nodes. In addition, this connection consumes very little electricity.

"L-Wave. Another wireless protocol belonging to one company - a manufacturer of microcircuits, including for Sigma Design "smart home" systems.

Insteon. This is perhaps the best protocol that combines a data exchange protocol over a power network with a wireless protocol. All nodes of the Insteon network are equal and can communicate with each other. If one node fails, communication goes through others. The developer of the protocol is the Smartlabs company. The protocol is compatible with X10.

Wi-Fi. This network protocol, which is used now not only by computer systems. Very fast, works well. And it is not surprising that some manufacturers began to make products for the "smart home" that use the advantages of this protocol. Other protocols consume less energy and use less bandwidth, but the capabilities of Wi-Fi are much wider.

Disadvantages of technology.

It would be wrong not to talk about the shortcomings of a smart home. To make a final decision, it is necessary to study the issue from all sides.

1. The main disadvantage of installing a smart home system is the cost of the equipment. The disadvantage is very subjective, since the system can consist of a number of engineering solutions for each building.

2. The risk of system interference is not excluded, since the technology depends on the equipment and its maintenance. To reduce risks, choose proven manufacturers that provide a full warranty for devices.

3. Another theoretical drawback is the leakage of information embedded in the system and its falling into the wrong hands (including information of a personal nature, health and other information that can be used for harm). Use modern protection systems, and remember that every Internet user is exposed to this risk to one degree or another.

Types and types of smart home.

There are several types of automated systems, fundamentally different from each other. Let's understand the principles of action and peculiarities of the functioning of each of them.

According to the management method, all smart homes can be divided into three groups:

- **Centralized automated systems;**
- **Distributed or decentralized systems;**
- **Combined control schemes.**

Centralized automated control systems.

The scheme assumes the presence of a control logic module, which is the "brain" of the system. The device analyzes the information received from numerous sensors and, based on this, gives commands to the performing devices. A freely programmable controller with the maximum number of outputs is most often used as a logic module.

Software is created based on the tasks to be solved by a specific automated system. The software is installed in a logical module, if necessary, changes can be made to the program.

Centralized system management has significant advantages:

- **The possibility of connecting any necessary equipment, including from different manufacturers.**
- **Ability to control all Smart Home (SH) subsystems through a common interface.**
- **Ability to create multi-stage complex scenarios, use cyclicity.**

The main "vulnerable point" of the scheme is considered insufficient reliability. Its performance is "tied" to the central controller. When it fails, the system stops. Theoretically, such devices have a large safety margin, but given that it will have to work around the clock for a long time, failure is not excluded.

Distributed or decentralized control systems.

Smart home elements are managed through a network of peripheral controllers. Each of them is a logical module with autonomous power, which is able to function independently of the main computer and store a certain amount of information in memory. necessary for management. Each peripheral controller is individually trained and programmed.

There is no single control center in the system, which allows it to continue working if one of the peripheral logic modules fails. Problems can occur only in the system connected to it.

The advantages of distributed management are considered to be:

- **Autonomy of operation of each of the subsystems, which significantly increases the reliability of the operation of the unified SH system.**
- **Possibility of expansion and installation of additional modules.**
- **A wide selection of elements to create such a scheme.**
- **Distributed systems are optimal for controlling the simplest mechanisms or light, controlling water, gas leaks, etc. Such a system does not have a single information space, pio significantly complicates the diagnosis of specific devices. For this, it is necessary to either survey the entire network, or use devices that record the characteristics of the equipment. Insufficient flexibility of distributed systems also creates certain problems.**

Combined control schemes.

The combined scheme is understood as a set of centralized and distributed systems with several control centers. Most often, such a scheme includes a leading centralized decision-making system and several auxiliary decentralized and centralized subsystems. This is how most modern smart homes are created.

The scheme combines two main types of systems and minimizes their shortcomings. The advantages of such a solution are obvious. Debugging of each of the subsystems is significantly simplified, and reliability is increased, since the master controller monitors the performance of each part of the system.

The most common and practical variant of the combined scheme is considered to be the following: each subsystem is controlled by a separate controller. Each of them, in turn, is subordinate to the main controller. A significant disadvantage of the scheme is the complexity of programming and the connection of all subsystems to a single network. And this can only be done by a well-trained programmer.

There is another classification of SH systems. According to the method of information transmission, they can be divided into two groups: wired and wireless systems.

Leading smart home systems

A wired system is a collection of devices connected to a network using cable connections. Such systems are distinguished by a wide range of services available to the user, as a large number of different components for leading circuits are produced. The functionality of these devices is as wide as possible.

Wired systems are reliable. the signal passes through the cable, which excludes the possibility of its interruption. The system is characterized by a high speed of information exchange. The wiring diagram makes it quite easy to integrate additional modules.

As conductive media for information transmission can be used:

RS -232 / 422 / 485. The oldest of the existing tires. It is characterized by the longest response time. It is used for automation of household appliances, air conditioners, gate controllers, etc.

A universal option, integrates with existing networks, which is both an advantage and a disadvantage. To avoid problems, it is worth physically dividing the network into two lines: for automation and for data transmission. In remote control systems, Ethernet usually becomes the bus that connects all the subsystems.

Power line. The most promising solution for the mass user, as it is present everywhere where electricity is conducted. Special protocols have been developed for its use, such as XI0 or the more modern Insteon.

Own tire. It is developed by the manufacturer specifically for its own products. Usually more reliable than analogues. The advantage of this solution is that the automation bus is separated from the general network.

The main disadvantage of wired systems is complex and time-consuming installation. In the course of its implementation, it is necessary to lay a cable, which is associated with the need to destroy walls and dismantle sections of the floor. Therefore, it is advisable to design and install leading schemes at the stage of construction or at least overhaul.

Wireless smart home systems.

In a wireless smart home, a radio signal is used to transmit information within the system. Unlike wired counterparts, they can be installed very quickly, with minimal intervention in interior decoration. This is the main advantage of such schemes. The possibility of expanding the network can also be considered an advantage, connecting new devices is extremely simple.

Automated SH systems differ in the type of data transfer protocol used in them. It can be:

• Open. It provides a standardized way of information exchange, because the equipment working with it is not "tied" to a certain platform. The choice of manufacturers is quite wide. There is competition among them, which forces them to work on the functionality and quality of devices. But the need to follow set standards prevents the development of fundamentally new technologies. The cost of the equipment is slightly higher than that of analogues with a closed protocol.

Closed. The protocol is developed specifically for the product of a certain manufacturer, so the equipment is not compatible with the products of other brands. At the same time, its cost is lower. The manufacturer is not bound by the need to adhere to standards, so there is a high probability of obtaining an interesting technological solution.

Technologies and equipment for smart home systems.
SH has a modular design, which includes functionally demarcated blocks. They are partially or fully integrated into the general network. Each of these modules-blocks performs its own task, but they are able to interact with each other as well. Any basic set of system equipment, as a rule, includes the following elements:

• Central control controller. It unites all elements of the system and ensures their interaction. A single-board computer in an industrial design is used as a control element, but you can use an ordinary system computer with certain software.

• Climate system. Provides a comfortable microclimate, consists of air conditioning and heating control modules. Its management is implemented using the analysis of data received from temperature and humidity level detectors.

• Light control system and switching of energy consumers. For its implementation, sensors of presence and degree of illumination or their combined models are mounted.

• Security and protection system. It is divided into three subsystems. Security and fire alarms are equipped with presence sensors, magnetic contact detectors, gas leak, smoke and temperature analyzers.

What are for motion sensors?

Motion sensors are a mandatory part of the SH system. They are necessary to turn on and off the lighting, are often used in the security and protection system, and are also necessary for the coordinated and well-thought-out operation of other SH systems.

In the case of security, the sensors detect the movement of outsiders and transmit a signal to the controller that controls the surveillance camera. The camera is directed to the place where the signal was received, and the owner of the house or the security guard receives a message about the disturbance.

Lighting control using motion sensors allows you to save up to 45% of electricity bills. The lighting is turned on only when there are people in the room. Such lighting is also very convenient for the veranda, corridor, stairs, front entrance, entrance and other areas of the home territory, where it is inconvenient to constantly turn the light on and off. Because these areas do not need constant lighting, automatic lighting is the best option.

The microclimate of a room is a set of physical factors and environmental conditions that determine its thermal state and affect human heat exchange. The main and most important factors that form the microclimate of the premises are the temperature and humidity of the air. To ensure the normal life of a person, it is necessary to create comfortable conditions inside the room. The created conditions depend on many factors, such as: season, time of day, weather conditions outside the premises, etc. Correction of the microclimate of the premises is carried out with the help of complex and specialized climate control systems.

The simplest microclimate control system includes modules for measuring temperature and humidity, and depending on their readings, the air conditioning, humidification or dehumidification systems are turned on.

Temperature and humidity sensor.

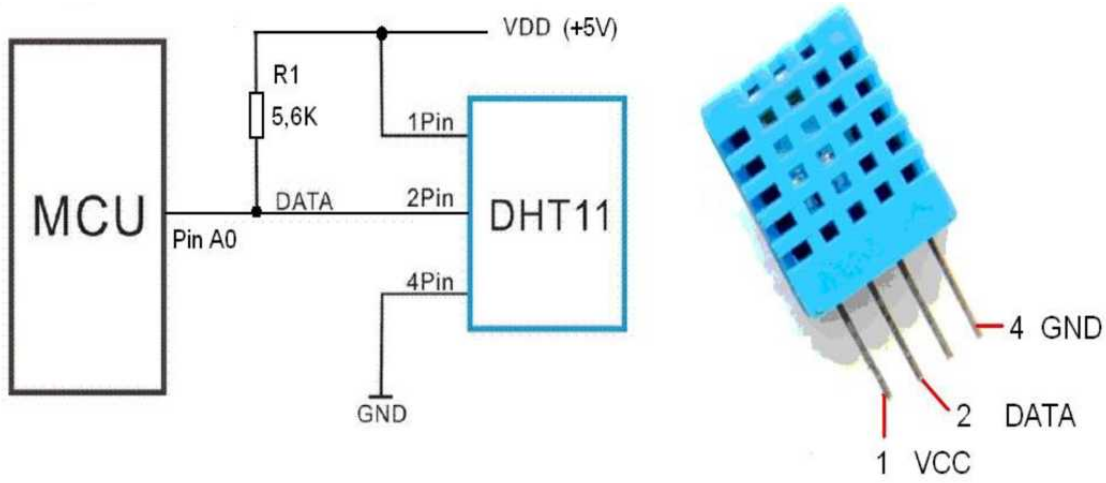
A DHT11 sensor can be selected to measure temperature and humidity. The DHT11 sensor is a digital temperature and humidity sensor that allows you to calibrate the digital signal at the output. It consists of a capacitive humidity sensor and a thermistor. Also, the sensor contains an ADC for converting analog values of humidity and temperature. Features:

- working voltage: from 3.3V to 5V;

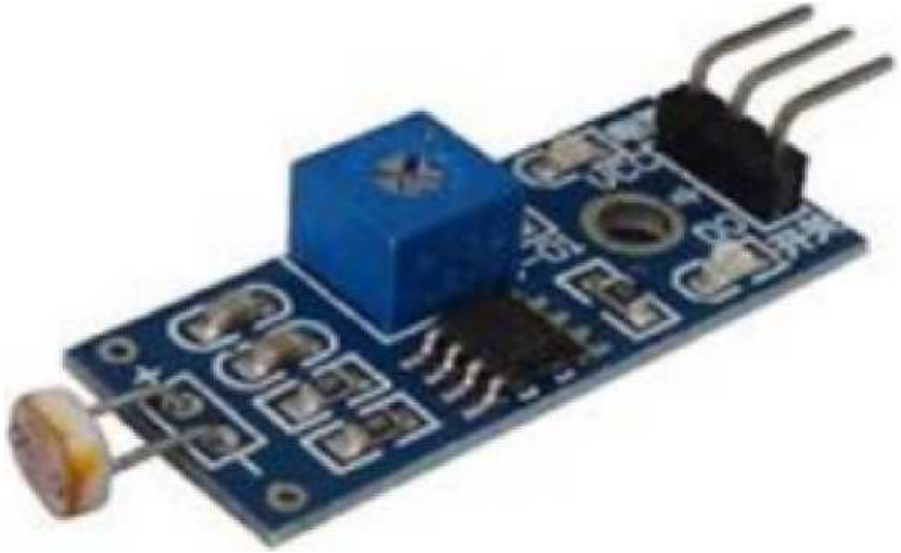
- determination of humidity 20-95% with 5% accuracy;

- determination of temperature 0-50° with an accuracy of 2°;

- polling frequency no more than 1 Hz (no more than once per 1 sec.).



To control the illumination, you can use a discrete sensor on a photoresistor, which responds to the amount of light flux acting on the sensitive element.



Appearance of a discrete light sensor on a photoresistor.

Connecting power loads to the Arduino can be done in many ways, for example through the opening of a transistor, thyristor, semistor or optocoupler. One of the simplest and most reliable solutions will be the use of mechanical relays for this purpose, and between them and the control circuit to protect against a possible electrical breakdown, it will be advisable to place an optical junction.

Ultrasonic distance sensor HC-SR04.

This rangefinder can serve as an excellent sensor for a robot, thanks to which it will be able to determine distances to objects, bypass obstacles, or build a map of the room. It can also be used as a sensor for signaling, which is triggered when objects approach.

Appearance of HC-SR04.

Water sensor.

It is possible to use an analog liquid level sensor as a water sensor. The working voltage of the analog sensor is 5V. The output voltage (reading of the sensor) depends on the degree of immersion of the sensor in the liquid and on the parameters affecting the voltage transfer coefficient, for example, the conductivity of the liquid.

Analog liquid level sensor.

Light sensor.

A light sensor module with a threshold comparator can be selected as a light sensor. The trigger threshold of the comparator is regulated by a variable resistor. Some of its characteristics are listed below:

- sensitive element - photoresistor;

- adjustment of the trigger threshold with a variable resistor:

- working voltage: from 3.3V to 5V;

- digital output of the comparator (0 and 1).

Light sensor module.

Motion sensor.

PIS (Passive Infrared Sensors) sensors allow you to detect movement. Very often used in alarm systems. These sensors are small in size, inexpensive, consume little energy, are easy to operate, and are practically not prone to wear.

Main technical characteristics:

- sensor operation zone: up to 6 meters:

- working voltage: 5 - 9V.

Motion sensor.

Sound sensor.

The sound sensor consists of a board on which outputs are mounted, a sound amplifier, an adjustable resistor and an electronic microphone sensitive to sound coming from all directions. The sensitivity regulator (variable resistor) allows you to choose which sound will trigger the sensor.

An expansion board for Arduino allows you to convert sound vibrations into a digital signal. When the membrane in the microphone oscillates from sound waves, the capacitance of its capacitor changes, as a result of which a change in the voltage at the outputs of the sound sensor is detected.

Sound sensor.

Color shade sensor.

The color shade sensor TCS230 for Arduino is capable of recognizing 4 colors and converts the intensity of the color spectrum into an output signal of different frequencies.

In the RGB color palette, any color can be represented as a combination of three primary colors: red (R). green (G) and blue (B). Therefore, to determine the color, it is necessary to measure the red, blue and green spectrum. As a sensitive element in the sensor, a TCS230 microcircuit is used, consisting of an 8x8 array of photodiodes - 16 photodiodes for three colors and 16 photodiodes without a filter.

Specifications:

- supply voltage from 2.7 to 5.5 V;

- automatic power off function;

- small error of the output frequency - 0.2%.

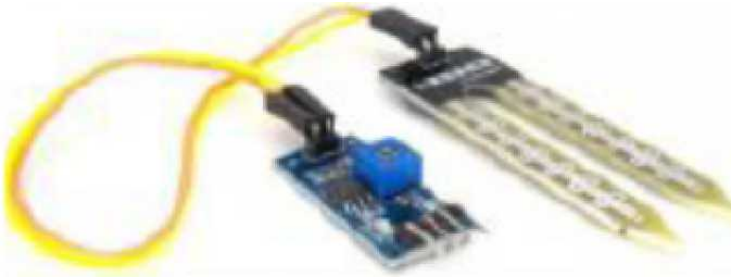
The sensor is used to determine the color shade of the object at a distance of up to 10 mm. There are four LEDs on the sensor to illuminate the measurement location. On the reverse side of the sensor there are two pads with four contacts. Through these contacts, the sensor is connected to the Arduino microcontroller. Contacts "S0" and "S1" are intended for scaling the frequency of pulses at the output "OUT" of the color shade sensor.

Soil moisture sensor

Soil moisture sensor with discrete and analog output. It consists of a sensitive element and a converter board. When the soil dries out (the drying level is set by an adjustable resistor on the converter board), a logic unit is applied to the discrete output. From the analog output, it is possible to obtain an exact value characterizing soil moisture, in the range from zero to the value of the supply voltage.

Technical characteristics: dimensions of the sensitive element 60 x 30 mm;

The sensor allows you to receive readings in two formats - an analog value of soil moisture (from 0 to 1023) or a digital value (dry/wet).



Soil moisture sensor FC-28.

Humidity sensor FC-37. The sensor allows you to receive readings in two formats - an analog value of the presence of moisture (from 0 to 1023) or a digital value (dry/wet).

Humidity sensor FC-37.

HC-SR505 infrared motion sensor or any other infrared sensor with digital output. The sensor allows you to detect the movement of objects (for example, people) in the area of the sensor. When triggered, the sensor outputs a logical unit and stores it for 8 seconds.

Infrared motion sensor HC-SR505.

One of the functions of the security system is to warn residents in the event of a fire in the room or in the event of a gas leak, for this task the MQ-2 wide range gas sensor is used.

The principle of operation of the sensor is based on a change in the resistance of tin dioxide applied to a ceramic tube that is heated, when heated to a certain temperature, the sensitive layer reacts to gas molecules, changing its resistance.

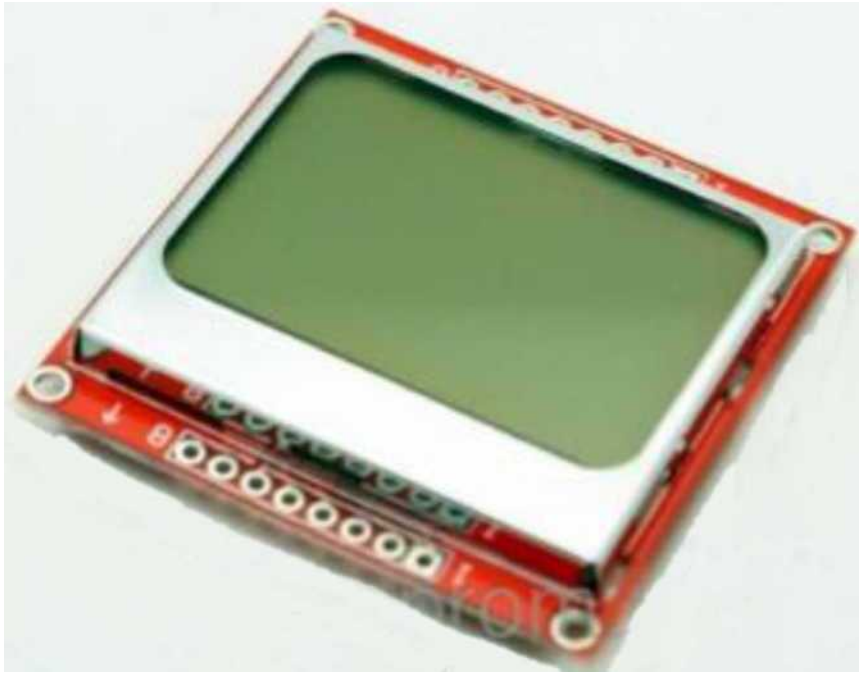
MQ-4 gas sensor (butane, propane, methane, smoke). The sensor allows you to receive readings in two formats - an analog gas concentration value (from 0 to 1023) or a digital value (yes/no).

MQ-4 gas sensor (butane, propane, methane, smoke).

Light sensor. A VT90N2 photoresistor is used as a sensor. Any other photoresistor with suitable parameters can also be used. The photoresistor can be used in digital mode and take two readings - sufficient or insufficient illumination.

Light sensor. A VT90N2.

The Nokia 5110 LCD liquid crystal display with a resolution of 84x48 points, presented in the figure below, is used to display information about the system indicators and adjust the parameters of the "smart home".

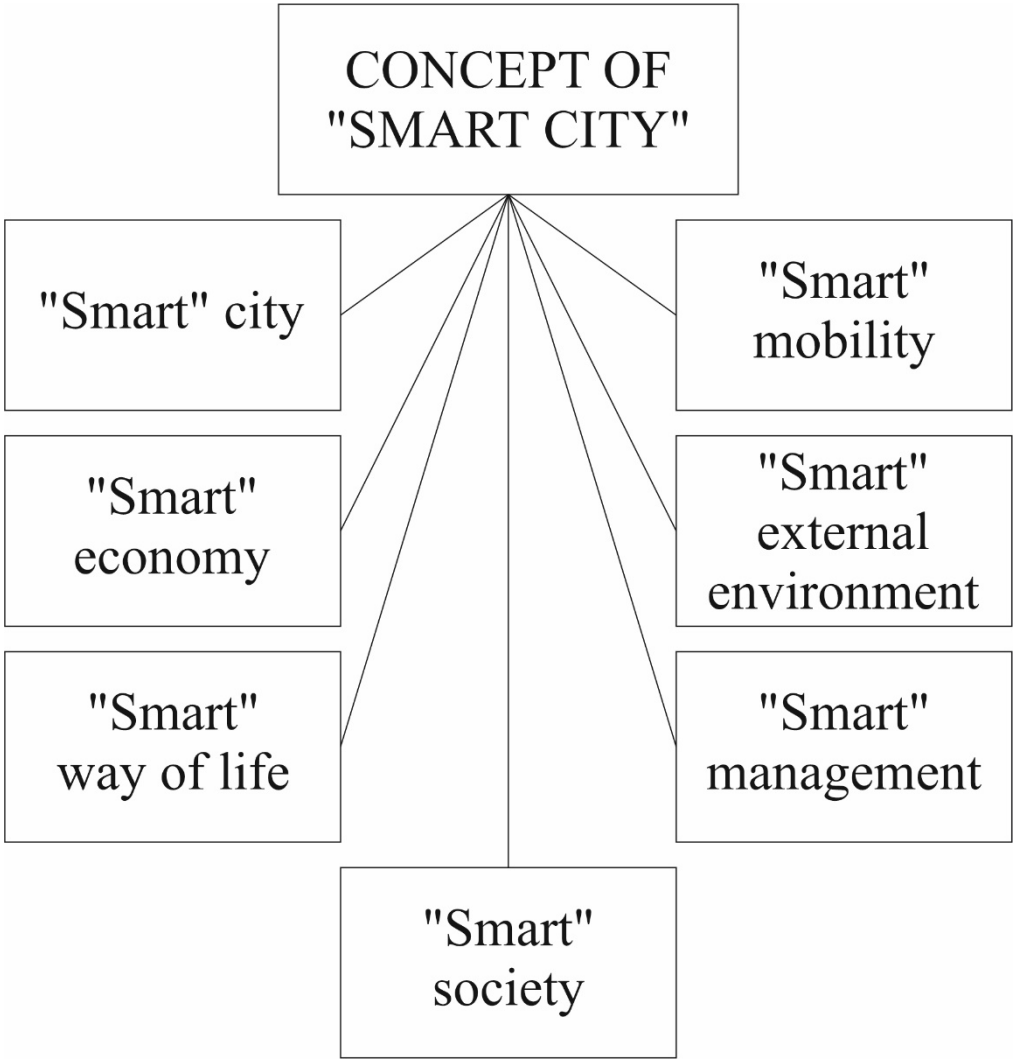


Liquid crystal display.

Remote control of the system inside the room makes it possible to control the system from a distance, for these purposes, an infrared remote control and receiver HX1838, which are presented in the figure, are used.

A smart house as a part of a smart city.

The "Smart House" technology has enriched the functions typical of an ordinary house, endowed it with feelings (sensors) and thoughts (controller, computer). Now the house has become in some sense "alive", capable of reacting to events, monitoring the owner and the territory, preventing leaks, etc. We create a house, endow it with intelligence, thinking, transfer part of our functions to its "shoulders". By purchasing a GSM Module, the user has the possibility of personal round-the-clock control and remote response in extreme crisis situations for his home. The system will not only accept everything necessary for home security, but can also notify the necessary services (law enforcement agencies, fire department, gas utility service) using a voice message. To do this, it is necessary to enter into the system the numbers of services that should be called in the event of an unusual situation and the corresponding voice messages.


CONCEPT OF "SMART CITY"
"Smart" city
"Smart" economy
"Smart" way of life
"Smart" society
"Smart" mobility
"Smart" external environment
"Smart" management

Existing projects of smart cities.

Pilot projects for the use of "intelligent networks" have appeared in the USA, China, and Europe. Accenture's "smart cities" consortium has become a global platform for cooperation and promotion of "intelligent technologies" by sharing knowledge, experience and ideas, based on the principles of active action and taking advantage. For example, the "Smart City - Amsterdam" project includes the installation of indicators in buildings displaying energy consumption data and advice on ways to save, the use of thermostats and automatic power switches instead of start screens, an energy audit that allows analyzing energy consumption data to identify new ways to save energy . "Smart" meters measure the volume of energy consumption, provide control to electricity companies and transmit information to end users. Installing solar panels on the roofs and walls of office buildings reduces the need for external power sources. A user-tailored power supply structure enables users to choose wind/water power generation methods, including actual supply. Sensors are used to control urban lighting, and conventional incandescent lamps are being replaced with LED ones. In "smart" buildings, energy consumption is reduced through the use of sensor-based light on/off and climate control systems.

Components and functional areas of smart city projects:

- video surveillance and video analytics;
- video recording cameras;
- intelligent transport systems;
- safety on public transport;
- radio communication;
- Internet of things;
- self-driving cars;
- biometrics;
- processing of unstructured data;
- decision support technology;
- virtual reality;
- distributed databases;
- geoinformation technologies;
- machine learning;
- cloud computing.

When building such a system, the following conditions must be observed:
Full autonomy of all local control systems, which allows maintaining the functionality of objects in case of partial system degradation. This involves:
1) storage of the main parameters of technological processes directly in the controllers and the independence of the system performance from the servers, from the operation of the communication channel and from each other.
2) making a decision on an emergency shutdown and introducing a reserve directly by the object's controllers to prevent a complete breakdown of executive devices and mechanisms.
3) Reliability of equipment, performance in a wide range of temperatures, work in conditions of low power supply reliability.
4) A single, reliable, communication channel that does not require high speeds and expensive special equipment, that has a high degree of reliability and an interference-resistant exchange protocol between controllers and servers.
5) The possibility of using any available communication channels: radio channel, cellular communication of GSM and CDMA standards, telephone lines, Internet cable network, local highways.

• The choice of a communication channel for each specific object should be determined by the importance of the object, the availability, the possibility of installing communication means, as well as the final cost of operation.

• For objects of increased importance, a primary and a backup communication channel should be provided.

• The possibility of using a combination of communication channels and the possibility of retransmission for access to remote and hard-to-reach objects must be provided.

• A single form of storage of data obtained from objects.

• A single exchange protocol between servers and dispatch centers.

• Use of various communication channels.

• Demarcation of access.

• Ease of information perception, quick access to operational teams.

• The possibility of gradually introducing new objects under control and management. Flexibility and expandability as users gain experience. Ease of entering new objects on the server.

• Low cost of operating equipment and communication channels.

Smart city

History of the issue and definition of the concept

The term "Smart city" began to be actively used in mass media in various countries in the mid-1990s, the influence of technologies that take into account the needs of tomorrow and the concept of sustainable development was growing in urban planning.

The European Union chose the seaside Spanish city of Santander as the first place to implement a large-scale innovative project. In 2008-2009, more than 12,000 sensors were installed here, which diagnose the amount of garbage in tanks, free parking spaces, the ratio of cars and pedestrians, and many other parameters.

In 2014, Copenhagen began large-scale reconstruction with the aim of making the capital of Denmark a unitary system designed to save electricity - energy, increase the level of safety, and reduce environmental pollution. Helsinki, Vancouver, Vienna, Singapore, New York, Tokyo, Seoul, Amsterdam, Lyon are also called "smart cities".

The structure of the "smart city".

"Smartcity" covers almost all spheres of life: state management, transport mobility, communal systems, health care, education, public safety, finance, trade, production, ecology and living environment. The main areas of activity are presented in the figure.

The most important components of a "smart city":

- innovative economy - introduction of innovations in the real sector, protected IT infrastructure, developed IT;

- city infrastructure - transport, energy / communal services, environmental protection;

- integrated management - transparent economy, representative and direct democracy, services for citizens and businesses;

- residents who ensure the functioning of the innovative economy.

Standard ISO 37151 "Intelligent infrastructures of communal economy. Principles and requirements for the system of performance indicators" will contain a methodology for evaluating the performance of the utility infrastructure of smart cities according to 14 categories of the main needs of the community (from the point of view of residents, managers and the environment).

The collection of data from cities and their analysis is carried out by the international organization of the World Council on City Data (WCCD), which performs the functions of certifying cities in accordance with ISO standards.

The use of standards helps to quantitatively measure the state of various directions in cities and identify problem areas. Using data-driven decision-making, cities improve key indicators and strengthen positions in the international WCCD register.

Metrics ISO standards reflect work in various directions: improving the quality of services, efficiency of infrastructure and individual facilities. This involves the optimization of energy supply systems, water supply, public transport, lighting, etc., which requires the comprehensive use of analytics.

The main advantages of implementing "smart city" technologies:

- for the transport sector - increasing mobility, reducing time spent on trips;

- for health care - cost reduction due to more accurate diagnosis of diseases, less burden on institutions, simplification of access to medical care, quality control of services, improvement of population health;

- for education - control of the learning process, personalization of programs, improvement of access to knowledge, quality of education;

- for finance - cost reduction, increased transparency, security and simplification of transactions, development of new payment systems, targeted distribution of budget funds;

- for the living environment - management of the quality of the natural environment and buildings, introduction of modern materials;

- for production and construction - optimization of production processes, control of resource consumption;

- increasing the general level of safety, including environmental safety (reduction of emissions and consumption of resources).

Existing "smart cities".

China. There are already many cities that claim the right to be called smart. The most famous is Yinchuan. It became the first city in the world in which bank cards, travel cards and, accordingly, cash are not required. they are replaced by a person: to pay for the service, you need to use the facial recognition system, and the required amount will be automatically debited from your account. All garbage containers are powered by solar batteries: the municipal service receives a message that the tank is full, and it is taken away. In the building of the local administration, the employees at the entrance have to replace the holograms. Many issues/procedures that used to have to be solved by contacting officials are now done online.

Japan. In 2016, a high-tech area was officially opened in the city of Fujisawa, where all buildings will use only solar energy, water consumption will be reduced by 30%, and in case of earthquakes, it will be possible to provide residents with hot and cold water for three days. you can ride only on electric cars, bicycles and scooters. Sensory lighting systems that recognize people are installed on the streets. All facilities are operated from the Fujisawa SST Square complex in the central city square.

Great Britain. Milton Keynes received smart status. In 2015, unmanned two-seater electric cars appeared on the city streets for the first time. They are equipped with 22 sensors, radar, panoramic and stereo cameras, and can travel 64 kilometers without recharging. Later, the MK:Smart project was launched. It collects all data about the city in one system: readings from satellites, sensors in the soil and energy and water consumption systems; information from video surveillance cameras with a recognition function; social and economic indicators. Thus, citizens can independently control energy and water consumption.

Singapore is also turning into a "smart city". As part of the government's SmartNation program, the Yuhua neighborhood is equipped with sensors that monitor water and electricity consumption, a vacuum waste disposal system, and solar panels. Special sensors are installed in the houses that monitor the movement of elderly people: if the system sees something unusual in their behavior, it sends a message to the hospital and relatives.

Analysis of information security threats of the smart house system.

A "smart" house should be understood as a system that ensures safety and resource saving (including comfort) for all users. In the simplest case, it should be able to recognize specific situations occurring in the house and respond to them accordingly: one of the systems can control the behavior of others according to previously developed algorithms.

But any system cannot be perfect. Information security threats are violations of confidentiality, integrity, and availability of information. The main threats to the "smart home" system are:

1) Attack by hackers;

2) Interception of information;

3) Viruses in the system;

4) Access by an intruder, in connection with the theft of rights.

There are also other threats that can affect the operation of the system - these are natural disasters, network outages, software errors, user errors.

The term "vulnerability" is used to denote a flaw in a system that can be used to intentionally break its integrity and cause it to malfunction.

The main vulnerabilities of the "smart house"1 system:

- Connecting the RB network to the Internet. In this way, with ineffective protection, virus programs may appear, and the probability of a hacker attack increases.

- With ineffective traffic protection, the probability of interception of information from communication channels increases;

- With a bad authentication and identification system, access by an unauthorized user due to data theft is possible;

The system still has vulnerabilities such as the human factor (sale of data), an ineffective system of protection against user errors, errors when using unlicensed software.

Possible consequences of threats:

- Disruption of work, or failure of the central server, and therefore the entire system.

- Violation of confidentiality, integrity and availability of information

- Violation of the confidentiality of information transmitted through the channel.

- Malfunctions in the software of the system, and therefore - disruption of operation or failure of the system hardware.

Such consequences as disorganization of system operation are also possible.