I.V. Purnak, O.V. Anchugova
Ural Federal University named after the first President of Russia B.N. Yeltsin
Ekaterinburg, Russia

«SMART HOME» TECHNOLOGIES

Abstract: This article is devoted to the description of the «Smart home» system as a whole and its constituent components, the consideration of the principles of building these systems, identification of potential security threats and evaluation of the usefulness for humans. The relevance of researching automation systems, economic benefit from its installation and the possibilities of the system were identified during the study. Three methods of building systems and its differences and features were considered. Various ways of implementing the system (from buying a ready-made solution to the self-build) their advantages and disadvantages, the technical possibilities were described. The attention was paid to the methods of the remote work with the system and emerging security threats.

Keywords: smart home, system engineering, automation.

И.В. Пурнак, О.В. Анчугова
Уральский федеральный университет имени первого Президента России Б.Н. Ельцина
Екатеринбург, Россия

ТЕХНОЛОГИИ «УМНОГО ДОМА»

Аннотация: Данная статья посвящена описанию системы «Умный дом» как в целом, так и её составляющих компонентов, а также рассмотрению принципов построения таких систем, выявлению потенциальных угроз безопасности и определению оценки полезности системы для человека. В ходе работы были

выявлены: актуальность изучения системы автоматизации, экономическая выгода от её установки, а также возможности системы. Рассмотрены три метода построения систем, их отличия и особенности. Описаны различные способы реализации системы (от покупки готового решения до самостоятельного построения), их плюсы и минусы, технические возможности. Описаны методы удаленной работы с системой и возникающая при этом угроза безопасности.

Ключевые слова: умный дом, инженерные системы, автоматизация.

1. Introduction

We live in the age of information technologies that simplify our lives and make it more comfortable. Every year new technologies and methods of their application in everyday life are invented. One of the manifestations of this phenomenon can be observed in the «Smart home», which is a modern type of a residential house organized for people's living with the help of automation and high-tech devices [1].

The development of «Smart home» technology has led to a qualitative change in the place and role of automation and building management systems. More and more people think about the concept of interconnection of various engineering equipment of buildings and organizational and technical solutions for operation using automation and control systems. The purpose of this technology is to create a system capable of maintaining safe and comfortable working or living conditions as well as to provide a simplified system of management of services and subsystems of the building. The modern system built on the «Smart home» technology can include subsystems of climate control and lighting, security alarm and video surveillance, water supply, remote monitoring and others.

2. Technologies of «Smart home» system

Nowadays there are three options for building a system of «Smart home»:

1. Centralized system. The centralized method of the implementation of «Smart home» technology is a combination of various sensors and

controllers in a single complex telecommunications network with a Central controller. A server, which is used as any modern computer and software with support for the necessary software and protocols, can be used in the role of the Central controller. This controller is the «brain» of the «Smart home» automation system. All main and auxiliary units are connected to the Central controller of the system and all components are equipped with their own microcontrollers, but they interact exclusively with the help of the Central controller.

The telecommunication network is the main element that ensures the functioning of the life support system. Through the network, information is taken from various sensors and transmitted to the main server for processing. After processing the information, the server transmits control signals to the actuators (water overlap sensors, switching on fire extinguishing means, door locks, etc.). Through the Central server, the «Smart home» is set up and managed by an authorized user as well as through it, if necessary, the transfer of the specified information to the owner of the apartment (office) in their absence (for example, unauthorized entry, leaks, fire). Such a telecommunication network can be built using both wired and wireless communication channels, for example, using Wi-Fi, Bluetooth, or 3G.

Using this approach allows combination of devices from different manufacturers which in turn reduces the cost of deploying the entire system. The main drawback is a large dependence on the work of the Central controller. Also, the user can connect the Central controller to the Internet for the purpose of controlling and monitoring, thereby, exposing the entire system to various threats and attacks. Another drawback is laying a large number of wires, so such work can be carried out only during the overhaul of the room.

2. Decentralized system. A decentralized approach involves deploying a system with distributed logic. In this case, the system consists of sensors, sensors and activators, and control is carried out within these devices; whether they are transmitters or receivers, devices communicate with each other directly and exchange information on a common channel – EIB bus and do not have a Central controller. The scheme of decentralized management has a simple and clear structure. It is completely autonomous and independent on the computer, reliable in operation, multifunctional, and allows you to flexibly reprogram the system to the user's wishes. With decentralized approach, in case of failure of one of the components, the system is broken only by the functional part which is the responsibility of

this component. Therefore, such systems are more secure and reliable compared to the systems implemented by the centralized method. Another advantage of using decentralized equipment is the ability to reduce the cable system. A significant drawback of this approach is that the design of the system requires high qualification and a lot of experience which in turn affects the cost of deploying the system. Prices for decentralized equipment are also higher as each device operates autonomously and has its own microprocessor — «mind».

3. X10 is a method and Protocol of transmission of control signals-commands for power wiring to electronic modules. The data are transmitted by short pulses of high frequency and synchronized with the moment of zero current passing. Messages sent from the device via the X10 network contain two information fields: the address of the device to which this command is addressed and the command itself. The X10 devices connected to the power supply receive messages, decode the recipient's address field, and, if it matches their own address, issue a command. Therefore, each controller of the «Smart home» system receives a signal regardless of who it was intended for [3].

3. Ways to build a «Smart home»

For the end user, it is important that with all the abundance of tasks that the system «Smart home» can perform, there are two main approaches to its implementation:

1. Buying a ready-made home automation system;
2. Organizing such a system on one’s own.

Both methods have their pros and cons. The economic benefits of building a «Smart home» with your own hands is obvious, but the quality and capabilities of the homemade version will depend on the knowledge of digital technology and the skills of its creator. The finished project will require less time and effort for installation and further maintenance. Companies engaged in the installation of «turnkey» systems as a rule issue a warranty of one year or more on the equipment installed by them as well as provide service. However, the installation of «Smart home» turnkey system can be rather expensive [2].

4. Remote work with the controller

One of the main functions of the smart home system is to monitor the stable condition of the house. In the event of any critical situation, the system should notify people about the incident wherever they are. There

are several methods of remote work with PLC, for example, e-mail communication, communication via SMPP Protocol (for sending SMS-messages) [5].

Meter readings, data processed by the microcontroller and a complete picture of the home can be uploaded to a web server updating the data as often as required by the host. Such readings are convenient for remote monitoring of the system. The user, in turn, can work with the web server data through the application on their device.

Messages about the system operation can be sent to the end user directly from the microcontroller, if it has the Internet access. The controller can manage all phases of network communication, from establishing a physical and logical connection to managing network addressing to negotiating protocols such as SMTP or HTTP. However, it should be taken into account that in this case the PLC is exposed to network threats.

To provide a network connection, you may need to configure the microcontroller and connect the network interface card. So, for Arduino devices you can use ready-made shields: shield for wireless communication, shield Ethernet and others.

5. Conclusion

Smart home is a fantastic technology gradually turning into reality. Such companies as Google, IBM and Microsoft are developing technologies for smart homes in their laboratories, but only recently, thanks to the powerful development of technologies and the cheapening of various sensors, the «Internet of things» is becoming a reality. It will take a little more time, and our homes will have their own intelligence and the Central node of their nervous system will have and roll such arrays of data that we never dreamed of.

The introduction of an automatic building management system will significantly reduce the cost of maintaining the premises, provide comprehensive protection of life and health of people, prevent serious accidents, significantly reduce the damage from them, and provide comfortable living conditions [4]. All this indicates the effectiveness of the system implementation, especially in the modern world. Technology is designed to make people's lives easier and a smart home is able to control every detail.

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