DOI https://doi.org/10.30525/978-9934-26-388-0-14

DEVELOPMENT AND RESEARCH OF THE SOFTWARE AND HARDWARE COMPLEX FOR CONTROLLING THE LIGHTING AND ALARM SYSTEMS OF THE SMART BUILDING

РОЗРОБКА ТА ДОСЛІДЖЕННЯ ПРОГРАМНО-АПАРАТНОГО КОМПЛЕКСУ ДЛЯ КЕРУВАННЯ СИСТЕМАМИ ОСВІТЛЕННЯ І СИГНАЛІЗАЦІЇ РОЗУМНОГО БУДИНКУ

Nazarova O. S.
Candidate of Technical Sciences, Associate Professor at the Department of Electric Drive and Commercial Plant Automation, National University "Zaporizhzhia Polytechnic" Zaporizhzhia, Ukraine

Назарова О. С.
кандидат технічних наук, доцент кафедри електроприводу та автоматизації промислових установок, Національний університет «Запорізька політехніка» м. Запоріжжя, Україна

Kazurova A. Ye.
Candidate of Technical Sciences, Associate Professor at the Department of Electric Drive and Commercial Plant Automation, National University "Zaporizhzhia Polytechnic" Zaporizhzhia, Ukraine

Казурова А. Є.
кандидат технічних наук, доцент кафедри електроприводу та автоматизації промислових установок, Національний університет «Запорізька політехніка» м. Запоріжжя, Україна

Bogunov R. V.
student at the Department of Electric Drive and Commercial Plant Automation, National University "Zaporizhzhia Polytechnic" Zaporizhzhia, Ukraine

Богунов Р. В.
магістрант кафедри електроприводу та автоматизації промислових установок, Національний університет «Запорізька політехніка» м. Запоріжжя, Україна

Many cities are competing to become smart cities, using smart services that can improve the quality of life. Smart city services have been found to play an important role in achieving people's desired outcomes [1]. In work [2], an intelligent system of a smart house was developed, which is designed to create a smart room from any house, office or building. The best solutions and tools were selected for the development of the system, which made it possible to create a fast, optimized, reliable and easy-to-use system with a

convenient mobile and web user interface. In [3], a smart home control system is developed that uses brain wave technology to achieve brain-computer interaction. The system is used to facilitate the daily rehabilitation of patients with disabilities and the rehabilitation of patients with limb disabilities. In Japan, the number of elderly households is increasing, which in turn increases the need to reduce daily housework [4]. Found ways to use equipment for convenience/reduction of housework and comfort. On the other hand, the problems faced by residents when deciding to use IoT home equipment remotely have been identified. The article [5] presents smart houses with the use of an energy management system and an intelligent network, which allows you to control the resources of the house in an organized manner without worrying about consumers, while minimizing overloading and overheating of the distributed substructure [6]. Computer models of software and hardware parts were developed to study the system of automated control of the house. The use of different types of simulations, including physical and computer, allows to expand the limits of experiments and increase the level of compliance of the developed system with real equipment. Research on models is relevant for many scientific areas: pneumatic transportation [7], automatic elevator control systems [8], study of electropneumatic mechatronic systems [9], electromechanical processes of the cold rolling state [10], automatic liquid level control systems [11].

The purpose of the work is the development of a software and hardware complex for controlling electronic systems of a "smart house" using a web interface.

A web-resource has been created, which includes the functionality of managing the smart home system, alarm display, as well as working lamps and sockets. The web resource provides remote management of electronic systems in the house. The system should have the following capabilities: change the states of lighting devices; change the state of sockets; display the current status of lighting devices, sockets and alarms.

When designing the system, the following recommendations and provisions are taken into account: the system interface should be as simple and understandable as possible for the user; the design of the web resource should be sufficiently informative; the registration window is not created and not used; Internet access is required for the operation of the web resource, the entire process of operation and management of the system must be carried out in online mode; the possibility of adding new elements and devices to the software and hardware complex should be provided; adding new elements should be done without disturbing the overall structure of the web resource.

After assembling the layout of the "smart home" system on the Arduino mega 2560 board and Ethernet shield w5100, debugging of the software code and subsequent testing of this layout was carried out. During the testing of the

software and hardware complex, the following shortcomings were found: when using remote control of the system, there is no such criterion as security. This is based on the fact that the control page does not have authentication and anyone who knows the IP address of the equipment can interfere with the system. During debugging, a bug was discovered where you had to refresh the page manually to see the alarm indication. This shortcoming was fixed by updating the signaling block every 10 seconds.

Conclusions. The most famous and popular today's "smart home" systems, mobile software applications, which are traditionally used for remote control of "smart home" systems, are analyzed. The main advantages of using Arduino, features of development in the Arduino environment, various approaches used in creating user interfaces, as well as methods and technologies necessary for their creation are studied. In the work, the functional requirements for the software product were put forward, the system architecture was developed, the basic layout of the "smart house" system designed to control the electronic lighting and alarm systems of the house was developed, and its debugging and testing was carried out.

Bibliography:

1. Santosa I., Supangkat S. H., Arman A. A. Value of Smart City Services in Improving the Quality of Life: A Literature Review. *2023 10th International Conference on ICT for Smart Society (ICISS)*, Bandung, Indonesia. 2023. Pp. 1-6, doi: 10.1109/ICISS59129.2023.10291571.

2. Lytvyn V., Vysotska V., Mykhailyshyn V., Peleshchak I., Peleshchak R., Kohut I., Intelligent System of a Smart House. *2019 3rd International Conference on Advanced Information and Communications Technologies (AICT)*, Lviv, Ukraine, 2019. Pp. 282-287. DOI: 10.1109/AIACT.2019.8847748.

3. Li Y., Zhang F., Yang Y. Smart House Control System Controlled by Brainwave. *2019 International Conference on Intelligent Transportation, Big Data & Smart City (ICITBS)*, Changsha, China, 2019. Pp. 536-539. DOI: 10.1109/ICITBS.2019.00134.

4. Ikezawa H., Imafuku M. Convenience Survey of IoT House Equipment for a Smart Life. *2020 IEEE 2nd Global Conference on Life Sciences and Technologies (LifeTech)*, Kyoto, Japan, 2020. Pp. 290-294. DOI: 10.1109/LifeTech48969.2020.1570619077.

5. Meena R., Dubey S. Smart Houses with the application of Energy Management System & Smart Grid. *2021 International Conference on Computing, Communication, and Intelligent Systems (ICCCIS)*, Greater Noida, India, 2021. Pp. 947-952. DOI: 10.1109/ICCCIS51004.2021.9397063.

6. Alquthami T., Meliopoulos A. P. S. Smart House Management and Control Without Customer Inconvenience. *IEEE Transactions on Smart Grid*, vol. 9. № 4. Pp. 2553-2562. July 2018. DOI: 10.1109/TSG.2016.2614708.

7. Nazarova O., Meleshko I. Experimental research and computer modeling of the obstruction occurrence in the pneumatic conveying systems peculiarities // *Herald of Advanced Information Technology*. 2020. Vol. 3. № 1. 428–439. DOI: 10.15276/hait 01.2020.9

8. Nazarova O., Osadchyy V., Shulzhenko S. Influence of Supply Voltage on the Accuracy of Two-Speed Elevator Positioning. *2021 IEEE International Conference on Modern Electrical and Energy Systems (MEES)*, 2021. Pp. 1-4. DOI: 10.1109/MEES52427.2021.9598664.

9. Nazarova O., Osadchyy V., Shulzhenko S., Olieinikov M. Software and Hardware Complex for The Study of Electropneumatic Mechatronic Systems // *2022 IEEE 4th International Conference on Modern Electrical and Energy System (MEES)*, Kremenchuk, Ukraine, 2022. Pp. 1-6. DOI: 10.1109/MEES58014.2022.10005698.

10. Назарова О.С., Васильєв Б.В., Шокуров Д.Р. Удосконалення системи діагностики стана холодної прокатки на основі бази даних його електромеханічних процесів / О.С. Назарова, // *Електротехніка та електроенергетика*, 2023. № 1. С. 7-18. DOI 10.15588/1607-6761-2023-1-1

11. Nazarova O. S., Osadchyy V. V., Rudim B. Yu. Research of the microprocessor liquid level automatic control system. Applied Aspects of Information Technology, 2023. Vol. 6. № 2. Pp. 163–174. DOI: https://doi.org/10.15276/aait.06.2023.12