MOBILE APPLICATION INTERFACE FOR DEVICE MANAGEMENT IN THE SMART HOUSEHOLD SYSTEM

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The article analyzes the features of the development of a complex information system called Smart Household, aimed at automating and improving the implementation of a wide variety of functions in a multi-disciplinary modern household, in particular, such as care for domestic animals, a garden, home territory, etc. The use of an effective mobile interface in this kind of system will allow household owners to monitor and control remotely a lot of useful functions using a mobile phone or a tablet. The Smart Household information system could help with the tasks of taking care of the home territory and a garden, automatic watering of the garden and lawn. The system can be configured for certain time moments according to weather conditions (temperature, humidity), which will allow economical use of water and provide optimal conditions for plant growth.

Key words: smart household; smart home; mobile application; information system; web development; interface.

Introduction

There is a rapid increase in the number of people who use modern information technologies and complex systems of the Internet of Things for household devices, engineering infrastructures for managing systems of the Smart Home, Smart Office, Smart Apartment classes, which in turn, are not always convenient and comfortable in use Therefore, the interface development of such systems in the form of a mobile application, which provides a convenient and efficient way of managing devices in such systems, is an urgent task. In addition, the growing popularity of complex solutions in the class of Smart Home systems generates the need to create mobile applications that would allow users to monitor and control comfortably household devices from a mobile phone. This once again confirms the relevance of research and development of an effective mobile application interface for the Smart Household complex information system.

The development of effective mobile interfaces for information systems of the Smart Home class is a rather popular investment and attractive direction. The development of such an interface for the Smart Household complex information system is an innovative high-tech solution to this problem.

An analysis of the state of studying the problem

Today, there is quite a large number of scientific publications, which provide up-to-date information on the results of research conducted on various aspects of this problem. Below there is an overview of current sources that correspond to the topic of the paper. The main emphasis in this study is on one of the subclasses of such systems.

The principle of using built-in functions for software design of Smart Home systems is considered [1]. The issues related to reducing software complexity and increasing its quality, which are important aspects of embedded software design, are analyzed [2]. The described methods and tools for achieving the set goals allow to increase the productivity of the software development process and reduce the time needed to create new products for building information systems in the field of smart houses [3, 4].

An overview of technologies that can be used for the development of a smart home control system interface is reviewed including Internet of Things (IoT), web interface, and mobile application technologies. The authors analyze the advantages and disadvantages of each of the technologies, as well as provide advice on choosing the optimal sequence of steps in the method of developing a smart home control system interface. In addition, the basic principles of the development of the smart home control system interface and the features of its implementation are described.

The authors analyze approaches to the development of an effective high-tech interface of the Smart Household information system that can allow the use of innovative information technologies, such as voice and gesture recognition, navigation of moving objects, which would make the use of the Smart Household system more convenient, comfortable and efficient [5, 6].

The best practices for designing navigation in mobile applications are analyzed, and what problems can arise when designing navigation in mobile applications and how they should be solved. The examples of well-designed mobile applications that can inspire the creation of new projects are considered [7, 8].

The purpose of the article is to analyze the procedures for creating a convenient, easy-to-use and intuitive interface of a mobile software application that allows a wide range of users of the Smart Household information system to look after family members, pets, domestic animals, maintain the functionality of a car garage, swimming pool, and take care of the home territory, garden, etc.

Approaches to the development of the mobile application interface

The development of a mobile application interface for managing devices in the Smart Household information system is an urgent task for modern society, in which the popularity of using smart technologies is rapidly growing. A smart household is a complex information technology solution that provides automation of a variety of processes in a modern multifunctional household and provides convenient control of a wide range of devices in the house and the surrounding area using a smartphone, a tablet or a personal computer. The development of the mobile application interface is an important step in improving the functionality of the Smart Household system, it provides convenient, fast and efficient access to the relevant devices in the house and in the surrounding area, it allows to significantly reduce the time for setting up and managing them.

The practical significance of this research lies in the fact that the development of a mobile application interface for managing devices in the Smart Household information system and its implementation allows to significantly improve the flow of management processes in home automation systems.

The general class of Smart Home information systems includes one of the subclasses of such systems, which are called Smart Household information systems. In general, these notions (concepts) are used to present generalized approaches to the processes of complex automation of a variety of functions in buildings, offices, and the home environment, as well as the effective use of a wide range of electronic devices and information technologies.

Smart Home information systems of the class usually contain a complex of sensors, network cables, controllers and other devices that, in a system combination, enable the home owner to manage various

technical systems. It provides increased comfort, safety, resource saving and improves other consumer properties of the house, and, in particular, the automation of the routine operations. Such systems are able to recognize specific situations that arise in the building and react accordingly. One target system can control the behavior of other subordinate systems according to previously developed algorithms. Moreover, we are talking not only about a set of various, different types of devices that can be controlled remotely, but also about a complete system of complex control of them. It provides competitive advantages to the user including control visibility, convenience, resource saving and time. Information systems of the Smart Home class are usually based on modern information and communication technologies that allow complex automation of various processes that occur in the home environment. In such buildings, the functions of lighting, heating, air conditioning, security systems, audio and video equipment, etc. can be controlled [9].

Smart Household information systems are a subclass of the broad class of Smart home systems, which includes integrated information systems that provide the most diverse automation functions in the environment of multi-functional, multi-planned households. Such systems can include both traditional lighting, heating, cooling and air conditioning systems, security systems, audio and video equipment, smart energy consumption control systems, and systems that ensure the implementation of garden, pet care functions, etc. In such systems, support for the processes of raising children, caring for the elderly, or people with disabilities, etc., must be provided.

A Smart household should be understood as a complex information system in which the possibilities of recognizing specific situations and analyzing the processes taking place in the building and in the surrounding area are realized. One of the metasystems can control the operation of other systems according to previously developed algorithms. One of the basic features of information systems of the Smart Home class is the unification of independent subsystems into an integrated system-controlled complex. An important feature and characteristic of a separate subclass of such systems, such as Smart Household, which distinguishes it from other ways of organizing living space, is that it is one of the most advanced concepts of system interaction of a person with a complex multifunctional living space.

Smart household is an integrated system solution for the effective functioning of a full set of possible life situations, preferences, individual characteristics and interests of all participants without exception, which together form such a social cultural production and recreational and efficiently organized high-tech living environment for a family as a basic system creative element of the modern society and human civilization in general.

Functionality and subsystems of information Smart Household systems

The Smart Household information system can help save resources thanks to the system's various operating modes such as comfort mode, night mode, nobody home mode. The mode change occurs according to the schedule or according to the command. For each of the modes, it is necessary to set the temperature only once on the display of the touch panel.

If the windows in the room are open for ventilation, the heating/air conditioning system can automatically turn off itself to save energy by sending a signal to the interframe contacts. In summer, their slats automatically turn at an angle, preventing excessive sunlight from entering the room without reducing the light flow. Thus, they prevent the room from heating up and help save electricity consumed by the air conditioner.

The Smart Household information system can send messages to a smartphone about everything that happens on the territory of the household during the absence of the owner: who and when came, how long this person was in the house. All their actions and faces are recorded and memorized in the system.

In case of an emergency (for example, a water leak), the system can not only notify the relevant services, but also take the necessary measures to localize the emergency (stopping the water supply).

During the absence of an owner, the house simulates the owner's usual lifestyle turning on lights and music at night to create the effect of presence [10].

The Smart Household information system was modeled using UML diagrams to understand better its functionality.

UML (Unified Modeling Language) is a language used in the object-oriented programming paradigm. It is an integral part of the unified software development process. UML is a general-purpose language, an open standard that uses graphical notation to create an abstract model of a system called a UML model. So modeling involves creating a model that describes the object. Unified (universal, single) is suitable for a wide class of designed software systems, different application areas, types of organizations, levels of competence, project sizes. UML describes an object in a single given syntax, so regardless of where and by whom the diagram was created, its rules will be clear to anyone who is familiar with this graphical language.

One of the tasks of UML is to serve as an effective means of communication within the team of developers of the information system and when the developers communicate with the customer. Like any other language, UML has its own model design rules and strict syntax. With the help of graphic notation, UML can visualize the system, combine its components into a single structure, specify and improve the model in the work process. At the general level, UML graphic notation contains 4 main types of elements, namely shapes, lines, icons, and inscriptions [11].
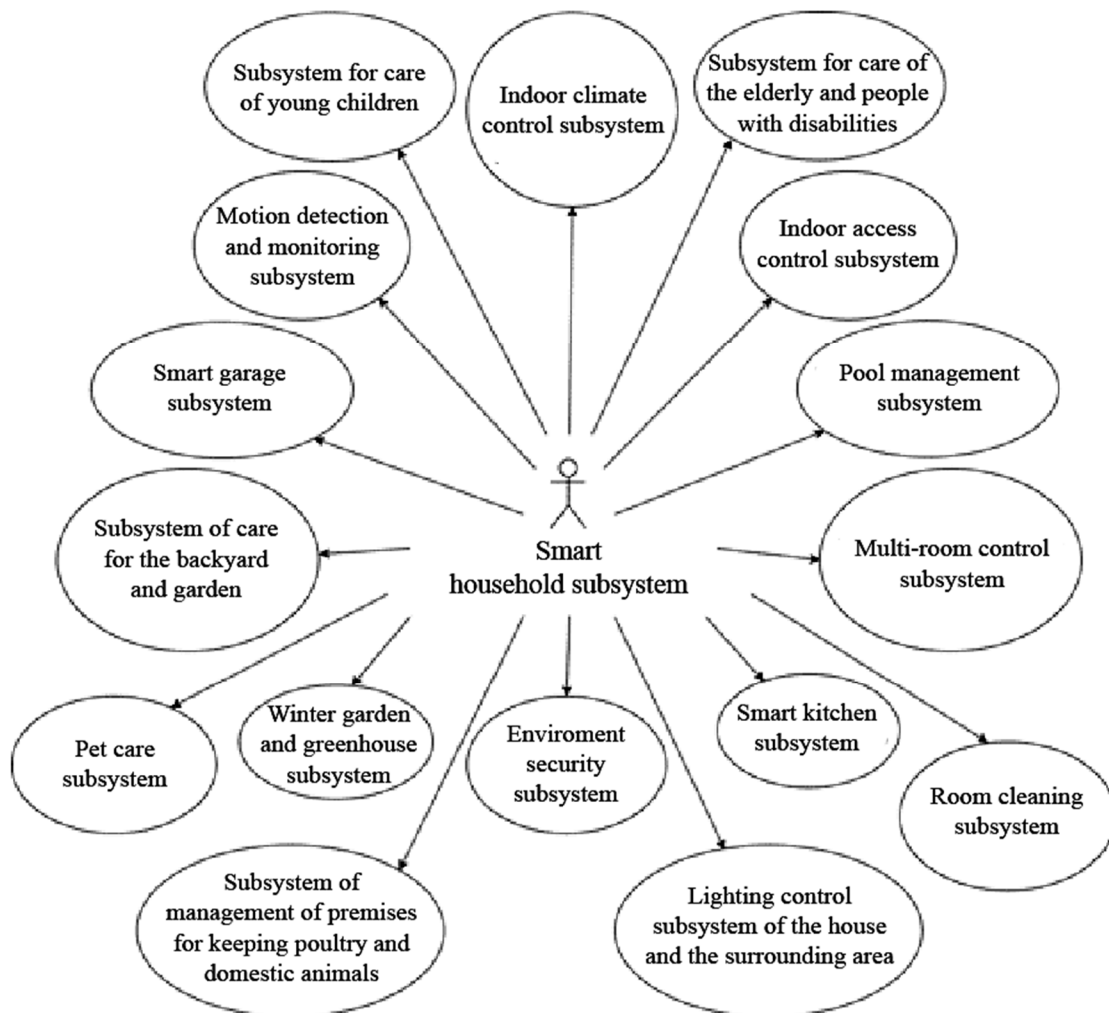

Fig. 1. Requirement chart in the subsystems of the Smart Household complex

Some UML diagrams are considered that have been created and used while modeling the functionality of the Smart Household information system. Requirement chart, or diagram of precedents

(Use Case Diagram). This UML diagram allows you to present the system functionality in the form of interactions between users and the system. It allows you to visualize the main functions that the Smart Household information system should perform and identify the users who get access to these functions. This type of UML diagram was chosen to visualize the functions of the Smart Household information system.

Smart garage subsystem – information about the status of the gate position is sent. Also, the history of the opening and closing time of the gate is stored in the system memory.

Motion detection and monitoring subsystem – door and window opening/closing sensors report any attempts to break into the household territory, and the video surveillance system automatically starts recording what is happening. With the help of motion detectors, the Smart Household security system prevents intruders from entering the territory. Each transmitter can be set to its own level of sensitivity so that it does not react to minor fluctuations or to pets. It is worth noting that the Smart intercom also has a built-in video camera and can generate sound signals and voice messages.

Subsystem of care for the backyard and the garden – the timer will take care of the accuracy of the watering time, defined by the user and the duration of watering in a specific given sector. Special soil moisture sensors will help to adjust the system operation providing the correct soil moisture coefficient only in the required areas of the garden or backyard. If it has rained in the backyard, the automatic irrigation system will cancel its own rain and water according to the user's set schedule (if one was chosen), since enough precipitation has already fallen on the territory of the garden and yard. The plot of land will never be overmoistened or too dry, the system will monitor itself the level of moisture on the lawns.

Subsystem of management of premises for keeping poultry and domestic animals – air temperature, ventilation, control of open windows and doors, ammonia concentration and air humidity are systemically controlled. If the room is heated, temperature sensors will help to regulate the heating system of livestock buildings, preventing too high temperatures. In order to avoid problems with improperly open windows, the sensors are installed that send messages to the smartphone of the owner or support staff about the open/closed status.

Environmental security subsystem – provides protection against water leakage, prevention of gas leakage and organization of ventilation, fire safety, etc. The water leak sensor measures humidity and temperature and automatically alerts the user before micro leaks become a problem. The water supply control system independently measures water consumption, detects water leaks and automatically shuts off the water supply in the event of a pipe burst.

Lighting control subsystem of the house and the surrounding area – provides remote control of any group of lights, binding to specific switches, switching on at set times, switching on by a light sensor, switching on according to a given algorithm in the system. For example, if the external blinds are closed, the light will turn on in the house. Lighting schemes, lighting scenarios, simulation of presence and automatic switching off lighting are all controlled by this subsystem.

Subsystem of multi-room control – provides independent simultaneous control of sound and video in all rooms, local or general muting, arbitrary or automatic one (during an incoming phone call, signal from the intercom). Selection of music or film is made for all rooms simultaneously or for any of them. The situation is excluded when system users may not hear the phone or doorbell due to loud music. The premises are voiced where the presence of equipment is not allowed.

Pool management subsystem ensures the implementation of pool management functions based on the indicators of special sensors such as rain sensor and motion sensors. The Smart Household system independently monitors the removal of blockages, removal of leaks, timely replacement and cleaning of filters. In particularly difficult cases, when the system cannot handle pool maintenance by itself, it displays all malfunctions on the screen of the mobile application.

Indoor access control subsystem – regulates entry/exit and movements of people or transport objects on the territory of the household for administrative monitoring and warnings of unauthorized entry. With

the help of the access control subsystem, it is also achieved the identification of people with the right to access, demarcation of access to different premises, control of automatic modes, time registration of a person's stay at the place, information processing and statistics.

Climate control subsystem of the house in general and in individual rooms – makes it possible to centrally control all systems, such as warm floors, air conditioners, pipe heating system, ventilation, etc. It also provides centralized regulation of the microclimate throughout the house or individually for each room, automatic maintenance of temperature and humidity in special rooms, switching on during certain events or according to a schedule, in particular, when a given sensor is triggered, air quality control, heating control scenarios.

Room cleaning subsystem in the Smart Household information system provides a number of functionalities that allow users to efficiently and conveniently clean the room. In particular, it is possible to schedule regular cleaning, control the process remotely, clean various surfaces, detect obstacles in your way, automatically clean dust and dirt after cleaning, and also configure the subsystem according to the user's needs.

Pet care subsystem allows users to provide optimal conditions for their animals and provide control over them. In the case of caring for dogs and cats, the subsystem can control the feeding schedule, water supply and regulate the air temperature in the room, which is especially important in winter and summer periods. It is also possible to control the temperature of the place where the animal sleeps. The subsystem can also control indoor humidity, which is especially useful for cats that need a certain level of humidity to maintain healthy fur and skin. For parrots, the subsystem can control the feeding schedule, set a special light mode that imitates natural lighting, and also control the temperature and humidity of the air in the room. For fish, the subsystem can monitor feeding schedules, monitor water temperature and its level, as well as provide information on the water state in the aquarium. The subsystem can also control aquarium lighting and adjust pH and solute concentration to provide optimal conditions for fish and other aquarium inhabitants. The subsystem can also monitor the filter operation and the presence of other water treatment systems to ensure the purity and quality of the water.

Subsystem for care of young children allows parents or guardians to monitor and control the safety and well-being of children at home. The subsystem can include a variety of sensors that monitor temperature and humidity to ensure comfortable conditions for children, noise levels, lighting and movement in the room. Video cameras and other devices can also be installed that allow parents or guardians to remotely monitor children and track their movements and ensure that children are safe. Furthermore, the system can have built-in audio and video players that enable you to play music, fairy tales and other materials for the development and entertainment of children.

Subsystem for the care of the elderly and people with disabilities makes it possible to provide care for people who need help, including monitoring their physical and moral condition with the help of sensors, monitoring medicine intake, reminders about visits to the doctor, as well as the possibility of emergency interaction with the medical personnel or emergency services if necessary. Also, the system can include functions of remote control of appliances in the house, for example, lighting or temperature, which can reduce the burden on an elderly person or a disabled person.

Subsystem for the care of the winter garden and greenhouse allows you to control the climatic conditions in the greenhouse, such as temperature, humidity, lighting, etc, with the help of sensors and an automatic control system. Besides, the subsystem can provide recommendations for watering and adding fertilizers to the soil, considering the needs of each plant individually, and can also provide control of plant pests and diseases.

The smart kitchen subsystem in the Smart Household information system ensures the implementation of functions related to food preparation and consumption. In particular, the system can provide access to recipes and information on the nutritional value of products, suggest the cooking mode, and also control the temperature and cooking time. Furthermore, the system can maintain the ideal condition of the products in the refrigerator, including the expiration dates, and also remind about the need

to order products. For convenience, the system can have an integrated monitor that makes it possible to order products online, as well as to adapt to the individual needs of users, for example, to prepare food taking into account allergies or special diets.

Advantages of implementing the modern high-tech concept of Smart household

A modern civilized person, regardless of occupation and income level, usually dreams of having an apartment or their own house. The 21st century is a century of technological progress, and the emergence of new technologies and new household appliances is happening very rapidly. All this makes living conditions much easier and helps to save a lot of time. Therefore, the concept of Smart household is exactly what is needed by a modern person who has limited resources, one of the most critical among them is free time, but at the same time seeks to control more and more processes, including those that take place at home.

The table reflects detailed positive characteristics and advantages of the modern Smart household concept.

Table 1

Positive characteristics and advantages of the modern Smart household concept

No.	Positive characteristics/ advantages	Description
1	2	3
1	Economical efficiency	Cost reduction for basic resources such as heating, water supply, air conditioning and electricity due to automatic regulation of these systems. There is also the possibility of remote monitoring of water and electricity consumption in real time, which allows the owner to reduce utility costs
2	Convenience	Remote control of all home systems using a smartphone application. This allows the owner to remotely control the temperature, lighting, security, and other systems, which provides greater convenience and comfort for the residents
3	Safety	Increasing the level of security due to automatic shutdown of gas, water, electrical appliances, as well as the possibility of remote control of the home security system, which includes fire and water detectors, a video surveillance system and automatic notification of emergency situations
4	Saving time	Smart household can significantly reduce the time that is necessary to complete a number of routine labor-intensive tasks
5	Flexibility	A smart home allows you to adjust the home systems according to the needs of the residents, depending on the lifestyle and preferences, the system can be configured to provide maximum convenience and efficiency
6	Environmental friendliness	The smart household helps to reduce harmful effects on the environment. The energy-efficient technologies, including solar panels and wind turbines, can reduce energy costs and carbon emissions, and an automatic irrigation system can reduce water usage and ensure efficient use of resources
7	Increase in real estate value	Installation of the Smart Household information system can increase the value of real estate and make it more attractive to buyers. In addition, such systems can reduce the cost of running a house, making it more attractive to buyers and renters in the market
8	Ease of use	Easy and convenient setup and use of the system, as well as the ability to automatically update the software to ensure optimal performance, realizes the principle of ease of use

1	2	3
9	Health and comfort of all family members	The Smart Home system allows people of any age and with different physical abilities to control and manage various aspects of their lives at home, which ensures comfort and safety of living
10	Expanding opportunities	The possibility of connecting various additional devices that allow you to expand the functionality of the system
11	Rest	Thanks to a smart home control system, the owner can be sure that the house remains safe, and all vital processes are controlled
12	Equipment status monitoring	The Smart Household system can provide monitoring of the state of equipment and devices in the house, which allows you to detect potential problems in time and avoid unforeseen situations
13	Improving the quality of life	Thanks to the convenience and security provided by the Smart Home system, the owner can enjoy a more comfortable and quality life
14	Reduction of insurance costs	Some insurance companies offer discounts on home insurance with a Smart Home system due to the increased level of security and reduced risks of unforeseen situations such as fire or theft
15	Providing comfort	With the help of the Smart Household system, it is possible to ensure comfortable living conditions in the house, to control temperature, lighting, air humidity and other parameters
16	Automation of routine tasks	The system grants to automate many routine tasks, for example, turning on/off lights and electrical appliances, locking doors, windows, and other equipment
17	Protection against emergency situations	The Smart Household system helps to protect the house from emergency situations, for example, flooding or gas leakage, and to prevent the occurrence of danger
18	Event notifications	The system can send messages to the owners about events such as the arrival of guests, receipt of packages, changes in the house etc.
19	Remote monitoring	With the help of built-in cameras and microphones, owners can remotely monitor their home and control external and internal security
20	Optimization of device operation	The system can analyze the energy consumption of various devices and suggest optimal settings to reduce electricity consumption
21	Access control	The system can allow or restrict access to the home, control who enters and exits, and provide security against unauthorized entry
22	Data protection	The system can protect the confidential data of the owners and ensure the security of their storage, preventing unauthorized access to the system and data

The given list of positive characteristics (parameters) can serve as a basis for determining complex (integrated) assessments of systems of the Smart Household class, it could serve as a good basis for conducting further research.

Despite the fact that the Smart household information system can characterize a lot of positive aspects, such as comfort, convenience and safety, it cannot include only advantages and positive characteristics. Therefore, there are some disadvantages as some control panels do not have sufficient

response speed or data transmission, which can be critical for users; in many cases, an individual exclusive project has to be developed for the household; sooner or later any device can fail and the Smart Household system is no exception in this case [12].

Summarizing the abovementioned, it can be stated that Smart Household information systems have conveniences, advantages, and positive characteristics. They make it possible to ensure a more comfortable and safe life in the house, reducing the burden on users and automating routine everyday tasks. In addition, they provide access to various resources and information in the house wherever you are with an Internet connection. This helps to save time, energy, and resources, which ultimately increases the efficiency and productivity of many processes in the household. The use of Smart household information systems allows to ensure a more comfortable and safe living in the house, which is a critically important factor in the modern world. It is important to continue to research and develop these systems to make them more efficient and accessible to a wider range of potential users.

Basic principles of user interface design processes
of the Smart Household information system

Designing user interfaces of mobile applications is the process of forming user interaction procedures with mobile device software. This process includes designing the graphical user interface (GUI), defining functionality and navigation, as well as managing user interaction with the application.

The history of requests for the design of user interfaces of software applications dates back to the 1970s, when there was a need and request for the implementation of comfortable human interaction with software systems. Starting from this point, interface designers work intensively on improving them and creating new, more efficient and convenient ones.

The use of mobile applications is becoming more and more popular, so designing user interfaces for mobile applications is becoming an increasingly popular process. A well-designed user interface can improve the experience of interaction with the application, increase its usefulness and efficiency, and also ensure the expansion of the number of potential users and their level of satisfaction from using the relevant products.

User Interface (UI) is everything about how the user interacts with the software, including graphic design, controls, element placement, colors, and fonts. UI is responsible for creating a visual effect and aesthetic impression of the user.

User experience (UX) is the new information, knowledge and practical skills of the user obtained by them as a result of the interaction between the user and the software, including their impressions, experience and satisfaction from the interaction. UX allows you to improve the process of creating a convenient, efficient and pleasant user interaction with software.

The combination of two components, UI and UX, and their systematic integrated processing allows developers to create optimal interface complexes. Designers of user interfaces of mobile applications take into account the needs and expectations of users, their behavior and habits of using mobile devices. This all includes factors such as screen size, selection of interface elements, ease of use and navigation, ensuring convenient and effective interaction between the user and the software product.

The design of user interfaces is an important stage in the development of information systems, including a mobile application that implements the main functions of the Smart Household information system. The basic principles of user interface design processes include understanding user needs, developing user interface documentation, testing and evaluating user interaction with the interface.

Analysis of mobile application analogues in information systems
of the Smart household class

Today, there are quite a lot of mobile applications on the market, which are multifunctional implementations of information systems of the Smart House class. At the same time, not all of them provide the full range of functions that should be in applications for the class of Smart Household information systems. The functionality of some of them will be analyzed.

One of the analogues is the Samsung SmartThings application. It is convenient and easy to use, but it does not have a full range of functions that would provide comprehensive management of the Smart Household. The application allows you to control devices connected to the system, such as smart light bulbs, thermostats, etc., but it has a rather narrow range of functions, which makes it impossible to fully automate the processes of the entire household [13].

Another analogue is the Google Home application, which allows you to control devices connected to the information network, but also does not have the full functionality that should be in an application developed for Smart Household. It allows you to control basic devices, but does not have an ability to create complete automation scenarios [14].

The Apple HomeKit application is another well-known analogue that allows you to control connected devices using a mobile device. It has a wider functionality than the software mobile applications as Samsung SmartThings and Google Home. It can perform lawn watering settings on the home territory, but it also does not contain all the functions that should be in a mobile application that would be a complete implementation of the Smart Household information system [15].

The Wink mobile application allows you to control smart devices in the house, and also implements some set of automation functions. However, it is quite limited in the implementation of certain functions and opportunities for integration with various types of devices [16].

Table 2

Analysis of analogues of mobile applications of Smart household information systems

No.	Application name	OC Android/IOS	Programming language and frameworks	Protocols, technologies	On the market since
1	Samsung SmartThings	Android IOS	Swift Java Kotlin React Native	Wi-Fi Bluetooth Zigbee Z-Wave	2019
2	Google Home	Android IOS	Flutter Kotlin	Wi-Fi Bluetooth Zigbee	2016
3	Apple HomeKit	IOS	Swift	Wi-Fi Bluetooth Zigbee	2014
4	Wink	Android IOS	Objective-C Kotlin	Wi-Fi Bluetooth Zigbee Z-Wave	2015

Considering the analysis of the abovementioned applications it can be stated that none of them implements the full functionality offered to the Smart Household information system under development. The developed mobile application for the Smart Household information system is more functionally rich than the analogues of applications for the Smart Household class information systems analyzed above.

Implementation of the interface prototype of the Smart household information system

The prototype of the interface of the Smart Household information system was developed using the Figma program, which can be used both in a browser (without downloading the application) and by installing it on a personal computer from the official website after registering in advance.
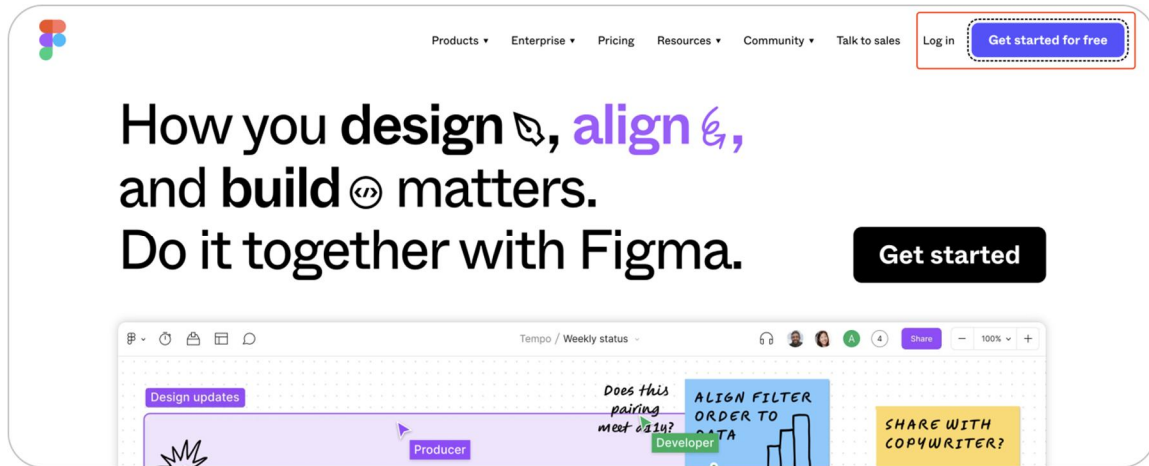
Fig. 2. Installing the Figma program [17]

It is worth noting the fact that the developers of the Figma program carefully took care of the interests of future users and created versions for iOS and Android platforms. It is possible to download a free version of the Figma Mirror program (for Android [18] and iOS [19] platforms), for further evaluation of the design on a mobile phone.

To start the program, click on the Figma program icon located on the user's desktop (Fig. 3).

Fig. 3. Launching the Figma program

After launching the program, two workspaces are available to the user, namely a graphic editor and a file manager, in which the user can create projects and edit personal profile settings.

You can create a new file in the Figma program through the Drafts or New File item in the right corner of the screen. The file name is Untitled by default.
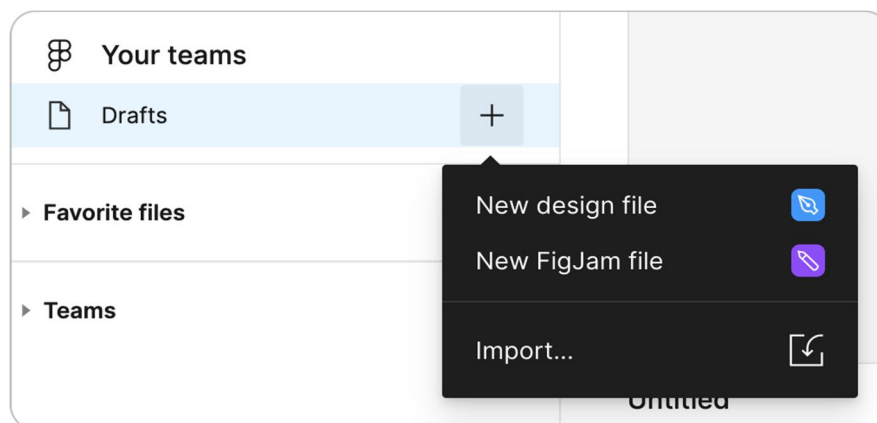

Fig. 4. Creating a new file in the Figma program [17]

Before starting a joint project, it is necessary to create a team by clicking the New Team button and create its name. It is possible to invite project participants by e-mail and mark their roles: viewing only or providing the ability to edit the file. Two people, including the project owner, can have editor rights using free tariff.

Fig. 5. Creating a team in the Figma program [17]

In the new file, three areas are available to the user for project development as the working area, toolbar, and layers panel. There are some important functions of the menu items: on the workspace, the designer places a frame on which all the elements created with the help of two toolbars available to the user and a layer panel with the help of which the specialist can easily move between the layers of certain blocks of the layout will be visualized.
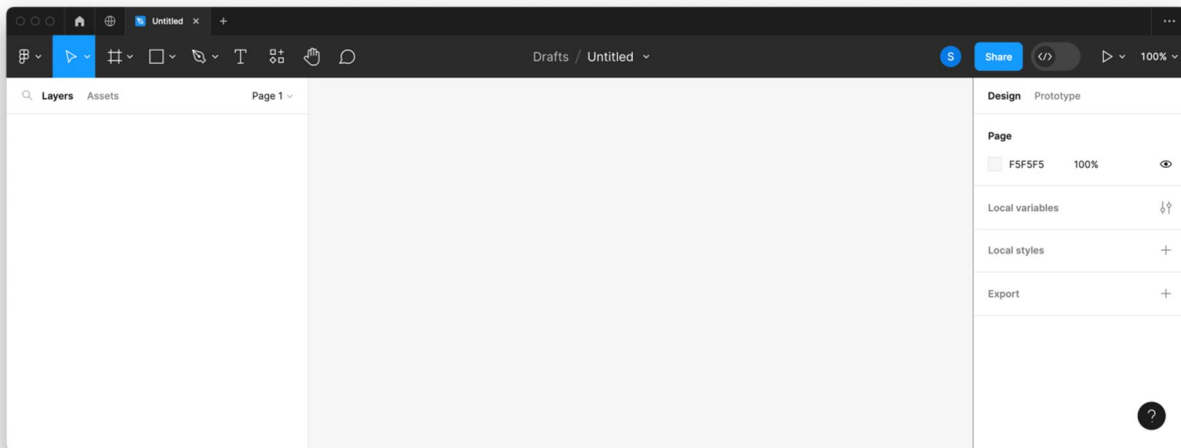

Fig. 6. Working area, two toolbars and a layer panel [17]

First of all, the initial Frame was created that is an area where all the elements of the layout are located.

A minimalistic design is known to be very effective for mobile applications, in particular for the Smart Household system. It provides a simple and clear interface, which is especially important for users who quickly switch from one task to another.

F9F9FB, which is light and soft, is chosen as the background color, which provides visual comfort for users and reduces their fatigue from long-term use of the application. The accent color is 282828, which is a shade of black, creates contrast and draws users' attention to important elements of the interface.

Choosing shades of black and white to create a design, it is important to consider the psychological aspects of color. For example, pure white can cause excessive brightness and glare, which can be unpleasant for users, especially in dark rooms or at night. Therefore, choosing white for the interface background, its light shade was used to reduce its saturation.

Thus, the use of shades of black and white colors in the project allows you to create an interface design that will be as pleasant as possible for the user and will provide convenience and comfort when using the mobile application of the Smart Household information system.
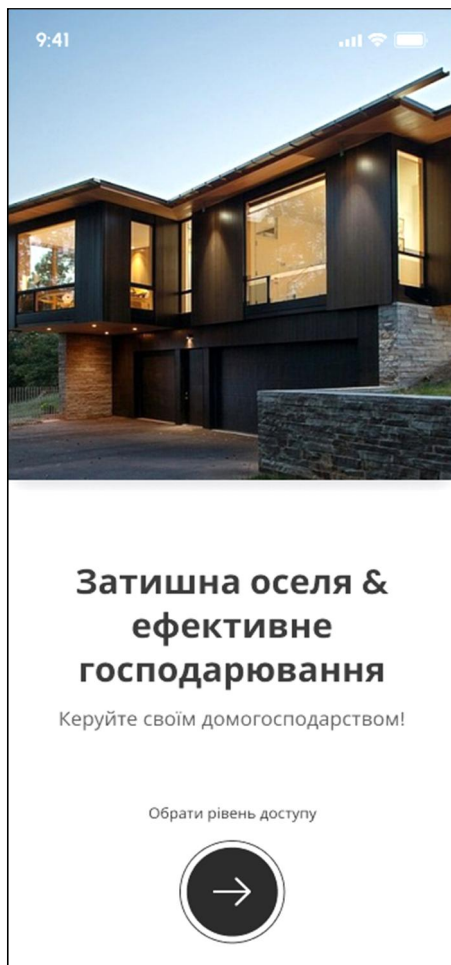
Fig. 7. Initial frame showing the application launch

One of the most popular is the screen extension for mobile applications with dimensions of 360 px by 815 px. That is why it was decided to develop the application interface on such a frame.
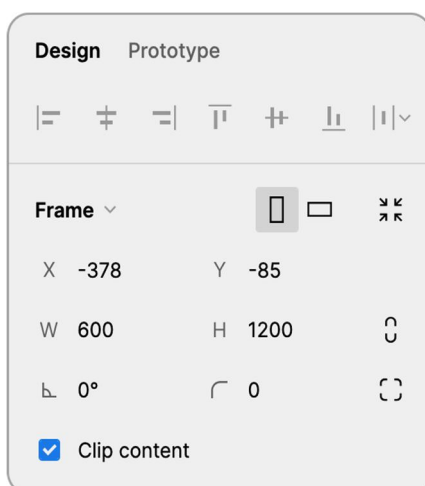

Fig. 8. Frame size adjustment panel

After launching the mobile application, the user goes to the Category screen (Fig. 9), where it is suggested to select the appropriate category to which the desired access will take place in the system. The

division into categories is justified because such a decision ensures the security of access to the functions of the information system, allows the administrator to control the capabilities of all system participants and prevent unwanted situations. The list of categories can be expanded.
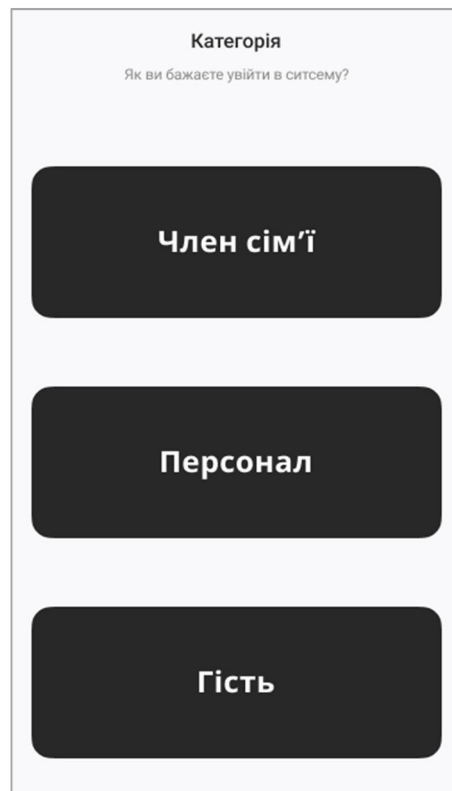

Рис. 9. Category selection screen in the application

Conclusions

The number of people who use modern information technologies and complex systems of automation of household devices, engineering infrastructures to manage systems of the Smart Home, Smart Office, Smart Apartment classes, which are not always convenient and comfortable to use, is growing rapidly. Therefore, the interface development of such systems in the form of a mobile application, which provides a convenient and efficient way of managing devices in such systems, is an urgent task. In addition, the growing popularity of complex solutions in the class of Smart Home systems generates the need to create mobile applications that would allow users to comfortably monitor and control household devices from a mobile phone. This fact again confirms the relevance of research and development of an effective mobile application interface for the Smart Household complex information system.

The development of a friendly interface of the mobile interface of the Smart Household information system is an innovative solution designed to increase the efficiency and ease of the system use in general and provide more comfortable living and management conditions in a complex spacious environment of a multi-functional household.

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ІНТЕРФЕЙС МОБІЛЬНОГО ЗАСТОСУНКУ ДЛЯ УПРАВЛІННЯ ПРИСТРОЯМИ В СИСТЕМІ "РОЗУМНЕ ДОМОГОСПОДАРСТВО"

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У статті проаналізовано особливості розроблення комплексної інформаційної системи "Розумне домогосподарство", зорієнтованої на автоматизацію та покращення реалізації найрізноманітніших функцій у багатопрофільному сучасному домашньому господарстві, зокрема таких як: догляд за домашніми та свійськими тваринами, садом, прибудинковою територією тощо. Використання ефективного мобільного інтерфейсу в таких системах дасть власникам домогосподарств змогу контролювати та дистанційно керувати багатьма корисними функціями, за допомогою мобільного телефону чи планшета. Інформаційна система "Розумне домогосподарство" може зокрема допомогти у вирішенні завдань із догляду за прибудинковою територією та садом, автоматичного поливу саду та газону. Система може бути налаштована на певні моменти часу, відповідно до погодних умов (температури, вологості), що дасть змогу економно використовувати воду та забезпечити оптимальні умови росту рослин.

Ключові слова: розумне домогосподарство; розумний дім; мобільний застосунок; інформаційна система; веброзробка; інтерфейс.