

EQUIPPING HOUSEHOLDS WITH DURABLE GOODS IN THE AGE OF THE INTERNET OF THINGS

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ABSTRACT

The purpose of this paper is to examine equipping households with some smart devices and to discuss the advantages of having and using them in households, as well as the reasons why households do not purchase these devices. The paper was written on the basis of secondary and primary sources of information. Direct research was conducted using the technique of an online survey on a sample of 620 representatives of households living in Poland in 2021. The results obtained indicate that households most often have house electronic devices, i.e., smart TVs and multimedia players. As for household appliances, most respondents possessed a smart vacuum cleaner, followed by a washing machine and a refrigerator. The most popular smart home automation devices are lighting (light bulbs) and heating (thermostats). The main advantage of using smart devices is to facilitate everyday activities by controlling devices from anywhere, whereas the reason why households do not purchase such devices is their high price and no need to possess them.

Key words: Internet of things, household, smart devices

JEL codes: D12, D19, O33, L86

INTRODUCTION

With the development of technology and electronics, the standard of equipping households with consumer home infrastructure is changing. The current development of Internet of things (IoT) technology provides consumers and their households with smart home devices and smart homes. The main factors contributing to the development of consumer adoption of the IoT are ease of use and facilitation of everyday life. The ease of use and control of devices working in IoT networks via mobile devices, mainly smartphones and installed applications, is also important [Mączik 2018a]. The IoT can be used for household needs and connects home electronic devices (e.g., smart TVs and streaming

servers), home appliances (e.g., smart refrigerators, dishwashers, washing machines), home automation devices (e.g., thermostats, smoke detectors, alarm systems) – but it also finds applications in industry, healthcare, and transportation in both urban and rural areas. In fact, within IoT, it is possible to include everything that can be monitored and controlled.

For modern consumers and their households, smart homes and smart devices are useful in everyday life. In the increasing reality of permanent lack of time and excess of duties, smart technology allows consumers to easily control devices from anywhere. Smart thermostats and lamps enable remote control of temperature and lighting, and configuration of timer programs. The work of smart devices can often be managed using

a single application that allows users to monitor their house, check if the TV has been turned off or change the air conditioning or washing machine settings – all in order to prevent the waste of energy, water, and money [Stańczyk 2020]. Taking this into account, having energy-saving appliances for resource-oriented households is one of the ways to introduce environmentally friendly solutions to everyday life.

According to information from Statista, the world's largest statistical portal, the total global IoT market was worth around USD 389 billion in 2020. It is forecast to grow to over USD 1 trillion by 2030. There are also predictions that the number of devices connected to the Internet of Things worldwide will triple over this period. Items intended for consumers and their households have the largest share in the IoT device market. In 2020, they were approximately 35% of the entire IoT device market. This share is expected to increase to around 45% over the next ten years. Research also shows that smartphones are the most frequently used devices with internet access by consumers, while at the same time acting as “connectors” between several smart devices [Statista 2021b].

As smart home systems have grown in popularity year by year, the widespread use of networked or network accessible devices in households has become a fact. The purpose of this paper is to present how households are equipped with smart devices that are connected to existing internet infrastructure or other network technologies, to discuss the advantages of owning and using them in households, and to explore the reasons why some households do not buy these devices. Two research assumptions were adopted indicating that most households are equipped with smart TVs, and that, despite the conviction that smart devices facilitate everyday activities thanks to the ability to control these devices from anywhere, most households do not have and do not plan to buy smart home appliances.

The paper presents a review of the literature and research related to the IoT, and to the equipping of households with smart devices. It describes the research methodology and the research sample, presents the results of the author's research, discussion, and conclusions along with recommendations for further research.

LITERATURE AND RESEARCH REVIEW

Ashton recognized himself as the creator of the phrase “Internet of Things”, stating that he “used the term as the title of his presentation for Procter and Gamble in 1999”. He considered that “the link between radio frequency identification (RFID) in the P&G supply chain and the internet was more than just a good way to attract the attention of P&G management” [Ashton 2009]. He emphasized that “computers, and thus the internet, are almost entirely dependent on information uploaded to the network by people. Almost all the data available on the global web describing things and phenomena were originally created and recorded by humans”. According to Ashton, “the problem is that people have a limited amount of time to enter all the data. Furthermore, they have limited attention and accuracy, which means that they are not very accurate to record and introduce all materials regarding real world objects into the virtual world”. Radio Identification System (RFID) and sensor technology enable computers to observe, identify, and “understand” the world and individual objects without being limited by incomplete, often residual, information entered into the network by humans. The Internet of Things enables not only people to communicate with smart things, but also communication between such smart devices. This leads to ensuring communication anytime and anywhere, that is at any location, using any information carrier [Kwiatkowska 2014].

The IoT can connect many different devices, both very small and large. The object does not even have to be in a physical form. The object may be data, e.g., information on the location and temperature in a room collected with a dedicated device (e.g., thermostat, smartphone) [Miller 2016]. Furthermore, both living creatures (human, animal), as well as plants and all inanimate objects in household equipment are perceived as “things” [Madakam et al. 2015]. Thus, all things that are equipped with, for example, detectors/sensors can create the IoT [Krawiec 2020]. This does not mean, though, that the object in question must be directly connected to the internet. However, in order to connect to the IoT, devices must be able to communicate, i.e., send and receive data, e.g., Auto-ID, short-range radio trans-

mission (e.g., Bluetooth, ZigBee) or Wi-Fi networks [Guinard and Trifa 2016].

In the position paper on standardization for the IoT technologies issued in January 2015 by the European Research Cluster on the IoT (IERC), the IoT is defined as a “dynamic global network infrastructure with self-configuring capabilities based on standard and interoperable communication protocols where physical and virtual ‘things’ have identities, physical attributes, and virtual personalities and use intelligent interfaces, and are seamlessly integrated into the information network” [Guillemin et al. 2015, quoted after Vermesan et al. 2011]. According to another source, the term “Internet of Things” was coined “to reflect the growing number of smart, connected products and highlight the new opportunities they can represent” [Porter and Heppelmann 2014].

Difficulties in defining the IoT means that it can be understood as: the use of RFID technology to determine the location (marking) of objects to monitor their position; machine-to-machine communication, meaning the communication of devices to optimize their functioning; using a network of sensors to transfer data and information from those objects to the network [Mazurek 2018]. The IoT is also perceived as all smart objects that can react to the environment, process and remember digital information, as well as transfer it to other objects (and users) via internet protocols.

The IoT consists of four basic elements: devices that allow for the active collection and transmission of measurement data that indicate their operation; the communication network that connects the devices (i.e., the internet); information systems capable of collecting incoming data; analytical solutions that process data and allow for inference and obtaining additional business value [Rozmus 2019].

According to a forecast by the research and consulting company Gartner, 8.4 billion connected “things” were used worldwide in 2017. Most users were consumers and their households – 5.2 billion. They utilized 63% of IoT applications used [Gartner 2017]. Statista data showed that the total base of IoT connected devices worldwide will reach 30.9 billion units by 2025, a soaring leap from the 13.8 billion units expected in 2021. By comparison, non-IoT con-

nections involving smartphones, laptops, and computers are expected to be just over 10 billion units by 2025 – three times less than IoT device connections [Statista 2021a]. Moreover, statistics from 2019 show that one in four Poles would like their home to be equipped with smart IoT equipment in the future, mainly to improve the quality of life. Most respondents would like to use IoT to monitor home utility usage as well as to monitor the home and their health [Statista 2019].

Durable goods that are part of household equipment are an element of home consumption infrastructure, which also includes an apartment or house. The IoT is widely used in areas related to home furnishings, especially the so-called smart home [Gunge and Yalagi 2016, Bhat et al. 2017]. This equipment includes, among others: smart devices, smart lighting, smoke and gas detectors, intrusion detection systems. These devices can be connected wirelessly to the internet and remotely controlled. Smart devices include: TVs, audio-video equipment, refrigerators, washing machines, ovens, dishwashers, vacuum cleaners, light bulbs, air conditioners, door bells and locks, devices included in heating systems, systems using security cameras and sensors for intrusion detection and alerting. Reflecting on the meaning of the word “smart” in relation to these objects, it seems that the most important thing is that many people will find that the name of a smart object is determined by the possibility of remote management, setting the timer for the start time, e.g., to heat the oven, turn on the dishwasher or washing machine. Instead of manually setting the timer, one can use an application on a smartphone or tablet to remotely start the equipment [Miller 2016].

Objects that can be connected to a smartphone or tablet are perceived as having enhanced functionalities. Mobile devices act as a control center for consumer electronics and household appliances connected to the home network. For the ordinary user skilled at using a smartphone, and in particular, skilled at installing a control application, using smart devices is easy, and adding another device to the home IoT ecosystem is not a problem [Maćik 2018b].

All smart devices are designed to automate various types of household chores. As a result of gat-

hering under one roof various smart devices, which communicate with each other, a smart home can be created. A smart home provides more convenience than its regular counterpart. There is less to do in it and less has to be remembered. Even a house with basic automation has some smart functions. In a smart home, apart from simply controlling and automating individual devices, smart devices communicate with other devices and synchronize their operation. A smart home can be seen as fully autonomous and working on behalf of its residents. It is the next step in the functioning of connected homes, where one can control devices from anywhere using the application. A smart house learns the behavior and preferences of people living in it. It adapts to these behaviors, anticipates needs, and reacts appropriately. It uses data collected from devices and sensors at home but also from wearable devices and even connected cars [Ekholm 2018].

In addition to the advantages, it is also worth mentioning the concerns about having smart devices and homes. A report commissioned by Dynatrace in eight countries (Great Britain, USA, France, Germany, Australia, Brazil, Singapore and China) on a sample of 10,002 respondents showed that 73% expressed concern of being locked in or out of a smart home. The inability to control the temperature in a smart home was indicated by 68% and light by 64% of respondents [Dynatrace 2018]. In addition, 53% of respondents are concerned about their data and stated that they would prefer information about them not to be collected, regardless of the device. According to Bitdefender, an antivirus company, less than 2/3 of all home network devices are typical IT devices: computers, tablets, laptops, routers, smartphones, and consoles. The rest are IoT devices, including various types of robots, automatic vacuum cleaners or smart light bulbs. It is predicted that the number of IoT devices will continue to grow, which significantly increases the risk of intercepting the data of their owners [Krakowiak 2020]. Therefore, when deciding to purchase smart devices, households must pay attention to information about the manufacturer's approach to publishing updates, removing reported errors and vulnerabilities, and to ensure the security of their data on an ongoing basis.

MATERIALS AND METHODS

Both secondary and primary sources of information were used to write the paper. Secondary information was adopted to characterize the discussed issues related to the IoT, smart devices, and smart home. Secondary sources were also used to obtain the results of research on equipping households with durable goods published every year by the Central Statistical Office (CSO) in the study "Household budgets." The results of secondary research were supplemented with primary information collected by the author in the form of direct research using the internet questionnaire technique from March 1, 2021 to May 18, 2021. The questionnaire was made available on the SurveyMonkey platform, and the link to the research was sent by e-mail to potential respondents. The research sample consisted of 620 household representatives, including 50% women and 50% men. It is not a representative sample. Respondents aged 18–24 accounted for 70% of the sample, and those aged 25 and more – 30%. 20.8% of the respondents lived in the rural areas. 27.7% of the respondents lived in cities up to 99,000 residents, 24.2% lived in cities from 100,000 to 199,000 residents and 27.3% lived in cities with more than 200,000 residents. Most of the respondents assessed the financial situation of their household as good (63.2%) and replied that they could afford some luxury goods. The financial situation of the household as sufficient was assessed by 26.9% of the respondents, meaning that they have to plan all major expenses. 9.4% of the surveyed households declared a very good financial situation and only 0.5% replied that their financial situation was bad.

For the purposes of the paper, it also seems interesting to define the respondents' competences in terms of the ability to use various devices and tools necessary to operate smart devices. 69.7% of the respondents declared very high skills related to using a smartphone, 50% to a tablet and 61.1% to various internet applications. When declarations of high and very high skills were compiled, the percentage of respondents increased to well over 90% (except for the tablet, where 76.3% of respondents declared skills at these levels).

RESEARCH RESULTS AND DISCUSSION

The analysis of surveys conducted annually by CSO on equipping households with certain durable goods indicates that most households have a television set. In 2019, almost 96% had them. Nearly 95% of households had an automatic washing machine. The proportion of households with a mobile phone is also growing year by year. In 2019, it was 97.1% of households (72.1% of which had a smartphone). The share of devices with internet access is also increasing in households. In 2019, it was over 80%, and compared to 2018, the proportion of households using these devices increased by nearly 5% (Table 1).

The information disclosed by the CSO provides only general knowledge about equipment with durable goods without specifying what percentage of them can be classified as smart devices. Therefore, in order to deepen the information on equipping households, in the course of direct research, respondents were asked what smart household appliances, smart radio and television equipment with internet access, remotely controlled, e.g., by means of smartphones,

tablets, they possess or would like to own in their household. It was found – in accordance with the adopted research assumption – that smart TVs were used the most in households of respondents (69.4%). Every second respondent declared that their household has a multimedia player (51%). Other owned devices were a vacuum cleaner (41.6%), a washing machine (39%), a refrigerator (38.9%), and an oven (36.9%). The lowest proportion of respondents declared that their households had a smart dishwasher (27.4%). Among other household appliances, the respondents mentioned a microwave oven, coffee machine, food processor, kettle, bathroom scale, toothbrush, alarm clock, car. When asking about the planned purchase of devices, it was found that most of the surveyed household representatives plan to purchase a smart TV (12.9%) and a vacuum cleaner (11.9%). Among all the appliances mentioned, the greatest proportion of people declared that they did not plan to purchase a dishwasher (62.7%) and an oven (57.1%) – Table 2.

Radio and television equipment as well as household appliances are only part of the connected house furnishings. Smartphones and tablets can be used to

Table 1. Equipping households with some durable goods in 2015–2019 (%)

Item	Years				
	2015	2016	2017	2018	2019
TV set	96.8	96.4	95.2	96.4	95.9
Device for receiving satellite or cable TV	66.5	62.2	60.6	62.0	62.6
Home theater set	13.0	11.7	10.4	12.2	12.0
Personal computer	74.2	75.2	75.9	74.1	72.8
incl. laptop, tablet	60.3	63.2	65.4	66.0	63.4
Device with internet access *	x	x	x	75.6	80.2
Multifunction printer	23.1	21.6	21.4	24.8	23.1
Mobile phone	95.2	95.7	96.2	96.7	97.1
incl. smartphone**	45.4	53.4	60.6	67.5	72.1
Automatic washing machine	95.5	95.8	96.3	95.1	94.8
Microwave oven	58.9	58.1	58.7	62.7	62.8
Dishwasher	27.2	29.2	31.8	36.4	40.1

* This category includes devices that enable connection to the internet, regardless of its class and type of Internet connection (e.g., desktop computer, tablet, laptop, smartphone, TV set).

** Despite including the smartphone in the “Device with internet access” category, due to its widespread and various applications, the level of equipping in the smartphone itself is also presented as a separate type of device.

Source: [GUS 2015–2019].

Table 2. Declarations of the respondents regarding the possession and intention to purchase smart electronics and household appliances (%)

Item	Respondents		
	owners	planning purchase	not planning purchase
Smart TV	69.4	12.9	17.7
Media player	51.0	7.2	41.8
Vacuum cleaner	41.6	11.9	46.5
Washing machine	39.0	7.5	53.4
Refrigerator	38.9	7.6	53.5
Oven	36.9	6.0	57.1
Dishwasher	27.4	9.9	62.7

Source: Author’s own study.

control via the Internet, e.g., lighting, temperature, roller shutters, alarm systems. Therefore, the respondents were asked what home furnishings, classified as home automation devices, their households had. It was found that most of them had smart lighting (44%), followed by heating (38%), sockets (37.5%), and door locks (34.2%). About 15% of the households surveyed possessed other things under study. These were air quality monitoring devices, weather stations, and alarm systems. 13.8% of the respondents were equipped with monitoring cameras, 11.9% had video intercoms, and 6.7% had window and door sensors. The photovoltaic inverter was mentioned among other smart devices

owned by the surveyed households. When asking about planned purchases of the analyzed devices, it was noted that the largest proportion of respondents declared the purchase of surveillance cameras (17.5%) and then lighting elements – light bulbs (15.7%). Most of the surveyed household representatives, i.e., over 80% of them, did not have and did not plan to purchase window and door sensors (Table 3).

During the survey, respondents were asked what, in their opinion, are the advantages of using smart devices by consumers and their households. It was found that, regardless of the gender of the respondents, for more than 3/4 of them the main advantage is to facilitate the

Table 3. Declarations of the respondents regarding the possession and intention to purchase smart home automation devices (%)

Item	Respondents		
	owners	planning purchase	not planning purchase
Lighting/bulbs	44.0	15.7	40.3
Heating/thermostats	38.0	13.9	48.0
Sockets	37.5	8.0	54.4
Door lock	34.2	6.2	59.6
Air quality monitoring devices	15.7	13.3	71.0
Weather stations	15.5	8.4	76.1
Alarm systems	15.0	14.1	70.9
Monitoring cameras	13.8	17.5	68.7
Video intercoms	11.9	12.5	75.6
Window and door sensors	6.7	12.6	80.6

Source: Author’s own study.

performance of daily activities thanks to the control of devices from anywhere. Greater convenience and comfort of everyday life were an advantage for 58.9% of respondents (more women than men indicated this advantage – 62.9% compared to 54.8%, respectively). Saving time thanks to the programming of repetitive activities performed by these devices was an advantage for every second respondent. In this case also more women than men mentioned this benefit (52.6% compared to 47.7%, respectively). Usefulness in everyday life was mentioned as an advantage by 45.8% of the respondents, while saving time thanks to controlling devices from anywhere by 37.4%, with more men than women indicating this benefit (39% compared to 35.8%, respectively). A sense of satisfaction and contentment with using smart devices was also indicated as an advantage by more men than women (27.7% compared to 23.9%), followed by an increase in the consumer’s free time (26.1% compared to 24.5%) and the fact that life is enjoyable and fun (23.9% compared to 19.7%). Among other advantages, the respondents mentioned the functionality of these devices and the sense of prestige that their possession gave (Table 4).

Taking into account that not all households have smart devices, the respondents were asked what, in

their opinion, are the reasons why consumers and their households do not buy these devices. Nearly 80% of them indicated that the most important barrier to purchase these devices is their high price. An important factor limiting the purchase of these devices, according to 59% of respondents, is the lack of a need to possess them. Other respondents mentioned a lack of knowledge about them (55.6%). For 43.4% of respondents, such a reason is their reluctance to adopt new technologies (45.2% of women and 41.6% of men). The lack of a sense of privacy due to the collection of data by these devices is a reason for refraining from buying them for 38.5% of the respondents, and for 36.5% such a reason is the belief that the use of these devices is complicated.

According to every fourth respondent, consumers do not purchase these devices because they are afraid of technical problems related to their installation and to the possibility of uncontrolled failure. The lack of a sense of security by relying on these devices for the management of simple household activities is the reason 18.2% of respondents do not buy them, and for 17.7% such a reason is the concern of getting locked in or out of a smart home (Table 5). Among other reasons, respondents mentioned the low efficiency

Table 4. Advantages of using smart devices by consumers and their households by gender of respondents (%)*

Item	Total	Women	Men
Facilitate everyday activities by controlling devices from anywhere	75.8	76.1	75.5
Everyday life is more convenient and comfortable	58.9	62.9	54.8
Savings in time thanks to the programming of repetitive activities performed by these devices	50.2	52.6	47.7
Everyday life usefulness	45.8	46.1	45.5
Savings in time by controlling devices from anywhere	37.4	35.8	39.0
Sense of security related to the control over everyday activities	28.4	29.7	27.1
Sense of satisfaction and contentment with using them	25.8	23.9	27.7
Ecological approach to life and influence on environmental protection by saving electricity, water, gas	25.6	25.5	25.8
Increasing the consumer’s free time	25.3	24.5	26.1
Daily life is enjoyable and fun	21.8	19.7	23.9
Saving money thanks to rational resource management	20.5	20.0	21.0
Other	1.0	0.3	1.7

* Respondents could choose up to 5 answers.

Source: Author’s own study.

of these devices, the fact that the devices they own work well and there is no need to replace them, and that having a smart function is not necessary. Another reason, in their opinion, may also be the high costs of replacing their devices with those that will be compatible with smart devices and problems related with the integration of devices that require the use of multiple applications instead of one, and the lack of need for households to undergo overall modernization – digitization. The reason may also be the fear of interference (break-in) by people from outside (thief, hacker) and the lack of support in the field of updating after the warranty or even before its end.

CONCLUSIONS

The continuous development of technology means that the modern consumer has to live in a most interesting world, offering a countless range of possibilities to communicate with each other, between consumers and objects, and objects themselves without consumers' interference to facilitate and improve everyday life activities. The availability of smart devices in households is increasing day by day, and smart home systems are becoming more and more common. The results of the research on equipping households with smart devices

indicated that most of the households under study had home electronic devices, i.e., TV sets (which was confirmed by the first research assumption). The second assumption was also confirmed, indicating that despite the conviction that smart devices facilitate the performance of daily activities in households thanks to controlling them from anywhere, the majority of the respondents do not possess and do not plan to buy these appliances to facilitate the improvement of their households. Although this is the advantage of using smart devices in the opinion of nearly 76% of the respondents, it is not reflected in the desire to own these devices. Less than 40% of the respondents had them, and those who did not, mostly declared that they did not plan to buy them. According to the respondents, the main reasons why households do not purchase such devices are their high prices and no need to have them. Less than half of the households surveyed declared the possession of smart home automation devices such as lighting (light bulbs) and heating (thermostats).

Finally, it is worth mentioning that, so far, no research has been conducted in Poland on the issue of equipping households with smart devices, thus the obtained results may be the basis for a discussion about consumer demand for smart things. Attention should also be paid to the limitation of the presented results,

Table 5. Reasons why consumers and their households do not buy smart devices by gender of respondents (%)*

Item	Total	Women	Men
High prices of devices	79.5	83.5	75.5
No need to possess them	59.0	59.7	58.4
Lack of knowledge about them	55.6	54.8	56.5
Reluctant attitude to new technologies	43.4	45.2	41.6
No sense of privacy due to data collection by these devices	38.5	36.5	40.6
Conviction about the use complexity of these devices	36.5	38.4	34.5
Technical problems related to the installation of these devices	25.3	21.9	28.7
Fear of the uncontrolled failure of these devices	25.3	22.9	27.7
No sense of security by relying on management of simple domestic activities by these devices	18.2	15.2	21.3
Fear of losing control of smart devices	17.7	18.1	17.4
Fear of getting locked in or out of a smart home	12.6	13.9	11.3
Need to update systems in these devices	10.0	7.7	12.3
Other	1.6	1.3	1.9

* Respondents could choose up to 5 answers.

Source: Author's own study.

both the CSO and author's own research. None of these studies presents the socio-cultural and economic context of the data obtained and the lifestyle of the respondents. In the case of CSO research, it is difficult to determine what percentage of the devices owned can be classified as smart (only the percentage of all devices with internet access is shown), while in the case of the author's own research, the limitation is the lack of representativeness of the sample and relying only on the respondents' declarations. In addition, no question was asked to establish which of the respondents already lived in a fully autonomous, smart home; the focus was on the possession of specific individual devices that do not always have to be synchronized with other smart devices used by households, but only controlled separately by mobile devices. This is therefore an open field for continuing research among the group of households with smart homes.

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WYPOSAŻENIE GOSPODARSTW DOMOWYCH W DOBRA TRWAŁEGO UŻYTKU W DOBIE INTERNETU RZECZY

STRESZCZENIE

Celem artykułu jest zaprezentowanie wyposażenia gospodarstw domowych w niektóre inteligentne urządzenia oraz omówienie zalet wynikających z użytkowania ich w gospodarstwach domowych, a także powodów dla których gospodarstwa domowe nie kupują tych urządzeń. Artykuł napisano na podstawie wtórnych i pierwotnych źródeł informacji. Badania bezpośrednie przeprowadzono techniką ankiety internetowej w 2021 roku na próbie 620 przedstawicieli gospodarstw domowych mieszkających w Polsce. Uzyskane wyniki wskazują, że najczęściej w gospodarstwach domowych są takie domowe urządzenia elektroniczne jak: inteligentne telewizory i odtwarzacze multimedialne. Wśród sprzętów domowych najwięcej badanych miało inteligentny odkurzacz, a następnie pralkę i lodówkę. Najpopularniejsze inteligentne urządzenia automatyki domowej to elementy oświetlenia (żarówki) i ogrzewania (termostaty). Podstawową zaletą wykorzystywania inteligentnych urządzeń jest ułatwienie wykonywania codziennych czynności dzięki sterowaniu urządzeniami z dowolnego miejsca, a powodami dla których gospodarstwa domowe nie nabywają takich urządzeń jest ich wysoka cena, a także brak potrzeby korzystania z takich urządzeń.

Słowa kluczowe: Internet rzeczy, gospodarstwo domowe, inteligentne urządzenia