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INFLUENCE OF THE SMART HOME TECHNOLOGIES ON THE INTERIOR DESIGN PRINCIPALS

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ABSTRACT

The features of the smart interior design are considered: area minimization, modes of operation, used materials and environmental changes.

A completely new services, provided by the smart interior are discovered, such as prevention of wrong actions, prediction of future actions and personalized services. Based on the above the extraction of new interior design principals (focused on the kitchen design) are concluded.

Key words: Smart Home Technologies, Interior Design, Digital Interior, Internet of Things.

INTRODUCTION

The penetration of the Internet of things (IOT) and smart home technologies introduces a new smart interior design, which is a synergy of creative and technical solutions, that should integrate smart materials, furniture, electronic devices, and environment for more comfortable lifestyle of the habitants (Kilic, T. et al. 2017, Risteska, L. et al. 2017).

The statistics shows that between 28 and 75% of the interior designers are interested in different aspects of smart home technologies, which is affirmed by the fact that in 2018 the market of the smart home devices has grown with 31% and reached about 640 millions of shipments (www.cepro.com). In the same study it is shown that the majority of the consumers (68% and over) are interested in the technical aspects of the smart home technologies and their applications in the kitchen (Figure 1).

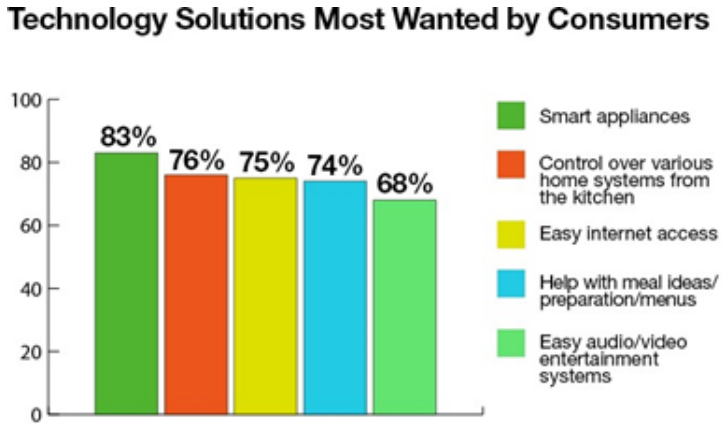

Figure 1: Customers interest in smart solutions.

In fact, the influence of the smart technologies on the design principals could be compared with that, done by Taylor's way of thinking, organization and management at the beginning of XX century and first of all it concerns the kitchen design principals, as the kitchen along with the

home energy management systems is the primary target for application of novel smart technologies.

On the wings of the digital revolution the modern interior and specifically the kitchen design is approaching toward a “digital interior”.

SMART INTERIOR DESIGN (SCOPE)

The first definition of smart building, done in 1981, determines it as building for “productive and cost-effective environment through optimization of four basic elements: structure, systems, services and management, and the interrelationship between them to meet the occupants’ needs” with emphasis on the technological solutions (So, A.T et al. 2012). The European Intelligent Buildings Group proposed that a smart building is based on design environment that maximizes the effectiveness of buildings while enabling efficient management of resources that results in minimizing life costs of facilities, tilting the spotlight towards the occupant’s needs to be served by technology (So, A.T et al. 2012).

Both definitions emphasize on the technological aspects, which nowadays means a massive implementation of IOT and Artificial Intelligence (AI) – based furniture and devices, that communicate with the habitants in the nanotechnology materials environment, providing for them a sustainable, efficient and comfortable life.

SMART INTERIOR DESIGN FEATURES

The process of introduction of the digitalization in the interior components opens the window to a new, sometimes unexpected possibilities in the design. Starting out from the above definitions and already large number smart homes projects and studies (Bittermann, N. D. et al. 2015, Marinova, M. 2016, Marinov, M. et al. 2017) the following features of the smart interior design could be derived:

- Communication

This feature is on the base of the implementation of digital solutions in the interior. Through communication channels (WiFi, Bluetooth, RFID etc.) the habitants could control the smart environment of furniture and appliances. Also, through communication the other features are provided.

- Integration

Communicating devices and furniture are easy to be integrated functionally, thus providing a higher level of effectiveness and comfortability.

- Transformation

This capability of adaptation of the space is an “old dream” of the interior designers. The new stilled furniture and devices, which communicate and could be integrated simplify the task of living space adaptation (transformation) to save energy, improve acoustic and comfort.

- Green solutions

One of the important contributions of the digital technologies is that they provided the possibility to incorporate the green solutions in the smart homes. Green solutions are an attribute of the smart home and interior design, which target is to improve the energy and water consumption efficiency (smart faucets, smart rainwater tanks, HVAC systems etc.).

SMART INTERIOR DESIGN TRENDS

The features of the smart technologies and the digitalization that penetrates in the interior design generate a new understanding of the smart home structure, interior, activities, materials to be used and interaction with the environment.

- New space planning

In fact, the abilities to communicate, integrate in combination with the miniaturization of the electronic part of the "digital" furniture, devices and appliances leads to reconsiderations of the dedicated living spaces in the interior. First of all it concerns the kitchen, where the influence of the smart appliances is a most strong. The new smart appliances, which are remotely controlled and integrated with others leads to minimization of the kitchen space on the account of the other living spaces or its distribution among them. In other words, there might be alternative solutions in space planning – customized, which implementation is simplified by the already mentioned features as communication, integration and transformation (adaptation).

- New ways of control and operation the digital furniture and appliances "assume humanization" of the interface with the habitants. These includes gesture and mimic control, natural language interface etc. On the top there are a possibility to have appliance –to – appliance interaction. All these abilities will also influence strongly on the flow process and micro-motion transfer in the kitchen and the movement in other living spaces.
- New materials

As everything smart the used materials should provide a proper environment to support on one hand the functionality of the smart appliances and on the same time to improve the comfort and sustainability. New nanomaterials as shape-memory, sound and electric non- reflective and energy effective etc. materials are already available and in use.

- Environmental interaction

Smart homes, due to the deep digitalization and thus a new way of living style will influence on the social and economic interaction of its habitants with the environment. A lot of traditional services will be not required or at least not obligatory such as cleaning, home delivery, medical surveillance, while others will be a must, such as digital ones.

SMART INTERIOR SERVICES

The implementation of the smart technologies in the interior design creates a completely new services, provided by the smart (digitized) furniture and appliances separately and integrated in a system. These services are an effect of the synergy of the exploitation of the IOT and AI technologies in the interior design. Embedded in the furniture and appliances the IOT components provides the information basics for AI systems to take and support the decision making for relaxing and productive habitant environment. As such the interior acquire new abilities, that provide in turn the following unique services:

- Personalized services

These are services, which are based on the installed IOT wearable and fixed sensors and robots provide personalized support of the habitant activities (for ex. sensors follow the habitant and provide walking lighting, proper air conditioning, serving by a robot etc)

- Preventive services

These are services that monitor and check for wrong and dangerous actions, that are or can be done by the habitant, guest or not authorized person. These include alarming if such a situation may occur and disabling of the wrongly used/activated device or appliance.

- Predictive services

The AI technologies provides the ability to predict possible actions by learning the habitant's behaviour. Thus, the smart furniture and appliances could be able to fulfil in advance needed operations/actions that will facilitate the habitant and save his/her time.

- Advising services

Another AI technology – decision support systems, implemented in the smart furniture and appliances could successfully advise and resolve everyday home situations, which need special care or actions (for ex. nursing elder people, care about children etc).

CASE STUDY: SMART DESIGN, FOCUSED ON KITCHEN DESIGN

Studying the history of the kitchen design it visible that the leading idea was to save the time of the women and optimize their efforts.

Starting from C. Frederick optimizations of the micro-motions in the kitchen (Figure 2), passing through the classic Frankfurt kitchen, then through European standards for kitchen ergonomics all efforts were directed to motion and operation optimization. And this task has been solved by minimization of the kitchen area and optimization of the furniture and appliances layout.

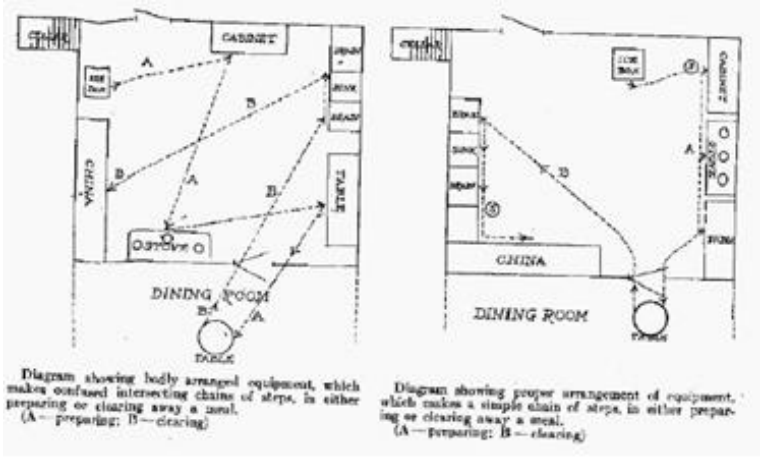

Diagram showing badly arranged equipment, which makes confused intersecting chains of steps, in either preparing or clearing away a meal.
(A—preparing; B—clearing)

Diagram showing proper arrangement of equipment, which makes a simple chain of steps, in either preparing or clearing away a meal.
(A—preparing; B—clearing)

From The New Housekeeping by Frederick 1

Figure 2: C. Frederick kitchen.

Using the above discussed advantages of the smart interior design a model of kitchen planning (layout) is presented in Figure 3.

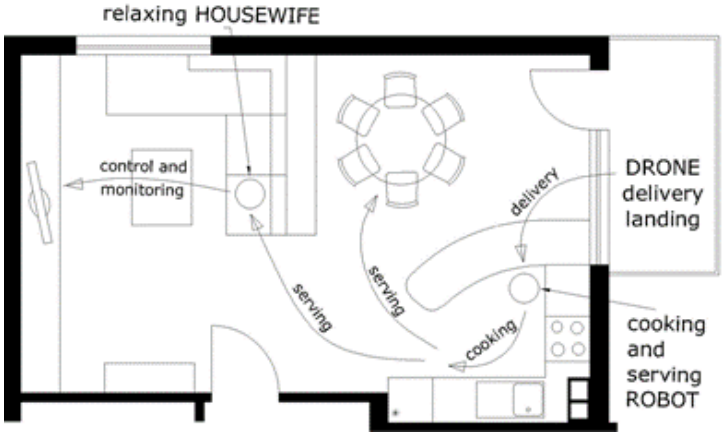

Figure 3: Smart kitchen example.

Thanks to the freedom and flexibility, provided by smart furniture and appliances a semi-open kitchen layout is designed, where a cooking robot is operating with specific appliances. The drone-based delivery provides the kitchen with products. This robot is also serving the dining room, from where, by the help of mobile phone, observing on the monitor the housewife controls the process, while she is taking rest or meeting guests. This control/monitoring function could also be managed remotely from the office, where she is working.

CONCLUSIONS

The Digital and Information revolutions undoubtedly give birth to the smart interior design.

Smart furniture and appliances starting to appear on the market, which needs designers' efforts to integrate them in a new projects, using their advantages in the name of more relaxing, comfortable and sustainable living.

The potential of AI, IOT and robotics are not limited to the discussed functions. With the further development of the technologies these functions will be enriched, thus saving habitants more time and improving their comfort of living.

REFERENCES

KILIC, T., BAYIR, E. 2017. *An Investigation on Internet of Things Technology (IoT) In Smart Houses.* International Journal of Research and Development, Vol.9, No.3, Special Issue, 197–206.

STOJKOVSKA, B. RISTESKA, L., TRIVODALIEV, K. 2017. *A review of Internet of Things for smart home: Challenges and solutions.* Journal of Cleaner Production 140, 1454–1464.

https://www.cepro.com/article/which_smart_home_technologies_interior_designers_want_nkba#.

SO, A.T., CHAN, W.L. 2012. *Intelligent building systems*. Springer: NY.

BITTERMANN, N., D. SHACH-PINSLY. D. 2015. *Smart home – a challenge for architects and designers*. Architectural Science Review, Vol. 58, No. 3, 266–274.

MARINOVA M. 2016. *Application of Expert Systems for shape forming elements choice in furniture design*. 6-th ESI Conference 2016, Pernik, Bulgaria.

MARINOV M, KOKORSKA, M., ROUMIAN, R. 2017. *Contribution of the Internet of Things Technologies to the World Heritage Conservation and Management*. Presentation at XV International Forum 'LeVie dei Mercanti World Heritage and Disaster, Naples-Capri, 2017.

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