Ana-Maria NICOLAU, Petruţa PETCU

INTEGRATION OF SENSORY DESIGN IN PRODUCT DEVELOPMENT

Abstract: *At the outset of design projects, our approach typically involves receiving a brief that often presumes a solution. However, in people-centered innovation, our focus shifts from the object or product to the real-life situations and habits of individuals. This paradigm shift entails prioritizing the diverse experiences and contexts of our target audience. Our project teams embrace this perspective by delving into the actual experiences of users with the product. By understanding their desires, needs, and sensory encounters, we aim to offer solutions that resonate with their lived realities. This approach necessitates a deep dive into users' activities, aspirations, and genuine requirements. The paper's objective is to meticulously gather and address these needs, crafting design solutions that truly align with users' preferences and aspirations.*

Key words: *Design, solution, needs, users, project team.*

1. INTRODUCTION

Innovation in product design represents an essential process to address the increasingly complex needs of contemporary society. This combination of creativity and technology not only delivers practical and efficient solutions but also contributes to the continuous evolution of the field and the enhancement of quality of life.

The first step in the innovation process is identifying consumer needs. To cater to all consumers, the selected product must be prominently promoted, necessitating a meticulously planned project [1-4].

A profound identification of users' needs and emotions, coupled with a focus on solutions respectful of both the individual and the environment, provides a robust framework for designing products that not only meet market demands but also contribute to a sustainable future in harmony with human needs.

The user requirements become a significant factor driving the evolution of product design in the era of service economy and rapid iteration of collaborative products [5].

With the development of user individualization and the enhancement of user requirement diversity, the traditional model of active product design alone cannot adequately address the needs of the current era [6].

Products are not just objects but also experiences. Innovations in design aim to create memorable interactions between the user and the product, engaging the senses and emotions.

Integrating sensory properties into the creative design process brings about a significant shift in our perspective on the objects and environments we create. By placing the senses at the forefront, doors are opened to deeper and more authentic experiences. This process not only transforms objects into artistic creations but also into captivating narratives, with protagonists endowed with a multitude of sensations.

In people-focused innovation, we concentrate on the real-life situations of individuals, their habits, and what they truly experience. It underscores the importance of understanding users' actions and emotions before, during, and after interacting with a product.

The project team implementing the product will consider the user's sensory experiences, the product's aesthetics, the use of environmentally friendly materials, as well as the possibility of reuse after the product's lifecycle concludes [7].

It is acknowledged that if consumers could participate in the product design process, their individualization could truly be achieved [8]. In recent years, researchers have presented several ways to make the design process open to users, such as participatory design [9], open innovation, and data-driven innovation frameworks for extracting user experience. [10 – 13].

In today's competitive and expanding global market, the competitive advantage belongs to companies that understand and rapidly respond to the dynamic requirements of users in product development. These companies are also capable of bringing the product to market faster and ensuring quality, reliability, and performance [14 – 15].

2. CONTEXT

The beginnings of modern appliances can be traced back to the 19th century when the first washing machines and vacuum cleaners were invented. These inventions revolutionized how people conducted household activities, increasing efficiency, and reducing the physical effort required.

In the 1980s and 1990s, with the advancement of digital technology, appliances began to be equipped with microprocessors and sensors, allowing them to offer more complex functions and be easier to use.

For example, among the appliances that have become increasingly popular, offering households the ability to cook in a very short time are:

a. Microwave (Figure 1)

The first microwave ovens had a simple and functional design, focusing more on performance than aesthetic appeal. They were typically large and bulky, with an industrial appearance, making them more suitable for

commercial use than for household use.

Figure 1 Microwave [16].

With changes in consumer preferences and adaptation to the smaller dimensions of modern kitchens, microwave ovens have evolved towards a more compact design. They have become smaller in size, lighter, and easier to integrate into the design of modern kitchens.

In recent decades, there has been increasing attention to the aesthetic aspect of microwave ovens. They have become available in a variety of colors, finishes, and models to accommodate different design preferences and harmoniously integrate into various interior decor styles.

b. Coffee Maker (Figure 2)

Before the advent of modern coffee makers, coffee preparation was primarily done using traditional methods such as pour-over filtration or infusion. Such methods involved the use of simple equipment like the cezve or manual filter.

With the transition into the 21st century, the design of coffee makers began to lean towards a minimalist and modern style. Coffee makers became more compact, with clean and simple lines, matte materials, and neutral colors, fitting perfectly into contemporary decor.

Figure 2 Coffee Maker [16].

c. Sandwich maker (Figure 3)

The first sandwich makers emerged around the 1920s and 1930s and were constructed from heavy and robust metals. These had a simple design, consisting of two heated plates that closed to toast the sandwiches. With technological advancements in the 1950s and 1960s, models with adjustable thermostats were introduced, allowing users to control the toasting temperature, and non-stick variants appeared for easier cleaning.

In the 1980s and 1990s, sandwich makers became increasingly compact and user-friendly, and with the transition into the 21st century, they began to adopt a modern and elegant design to complement the contemporary decor of kitchens. Versions with stainless steel finishes, LED lighting, and other aesthetic elements were introduced, making them visually more appealing.

Figure 3 Sandwich maker [16].

d. Bread toaster (Figure 4)

Bread toasters, introduced in the 19th century, featured a simple and sturdy design. These often consisted of two metal plates mounted on a hinge, which could be opened and closed to toast slices of bread. Over the years, new functionalities such as timers and adjustable toasting settings were added.

In the 1960s and 1970s, emphasis was placed on compactness and practicality. Bread toasters became smaller, easier to use, and introduced insulated handles and other safety features to protect users from burns.

Figure 4 Toaster [16].

The evolution of household appliances in the modern era has been spectacular, marking significant progress in technological advancements and household comfort. Presently, technology continues to advance in the field of kitchen appliances, with a focus on energy efficiency, smart functionality, and modern design.

The trend towards purchasing smaller homes, such as studio apartments or tiny houses, has become prevalent in many urban areas worldwide. This shift in living preferences has led to an increased demand for multifunctional and compact appliances.

In this context, multifunctional appliances become a practical solution, allowing users to benefit from multiple functions in a single device, thereby saving precious space. Additionally, in a world where time is a precious resource, multifunctional appliances offer a convenient solution for busy individuals.

The necessity of kitchen appliances is evident from people's desire to cook and serve food in a more efficient, flavourful, and healthy manner. These appliances not only save time and effort but also enable the preparation of a wider range of dishes and menus, thereby contributing to a better and more comfortable life [17 – 19].

Design and redesign are essential pillars in product development, playing a crucial role in adapting to technological changes, consumer needs, and market requirements. These processes not only enhance the aesthetics of products but also optimize their functionality, efficiency, and durability.

Design is a creative process that integrates aesthetics, functionality, and ergonomics to create innovative and attractive products. Redesign, on the other hand, involves revising and adjusting an existing product to improve performance or respond to changes in the surrounding environment. It can be motivated by customer feedback, technological advancements, or the need to adapt to new standards and regulations.

Efficient design takes into account aspects such as the user's sensory experience, sustainable materials, and market trends. Incorporating sensory properties into the creative design process is an innovative approach that emphasizes physical experience and human perception. This integration brings tangible and stimulating elements into the creation process, significantly impacting how products and environments are designed and experienced.

Visual appearance remains, of course, a crucial component of design, but the introduction of tactile sensations adds a new and captivating dimension. Different textures, pleasing-to-touch materials, and ergonomic shapes can transform an ordinary object into a pleasant tactile experience. Thus, not only sight but also tactile sense becomes a tool of artistic expression.

Integrating sensory properties into the design process aims not only to add elements to objects or environments but to create holistic experiences. By consciously addressing each sense, designers can construct not only products but entire sensory narratives.

Design and redesign are the engines of innovation and success in the current market. In a constantly changing world, companies that approach these processes with creativity, adaptability, and attention to user feedback are the ones that will thrive and prosper in global competitiveness.

Attractive and innovative design provides a competitive advantage, attracting customers and highlighting the product in front of the competition, while well-executed design optimizes the user experience, making the product easier to use and more enjoyable. Additionally, integrating durable materials and eco-friendly processes into design contributes to reducing environmental impact.

Designers use technical drawings as a means of communication. Before starting the design project, it is essential to establish a plan for each stage, from identifying requirements to creating CAD models. During the process of generating different forms, computer-aided three-dimensional visualization is used to analyse them from various perspectives, such as functional, technological, and aesthetic ones. [1, 2, 13].

In this context, the work focuses on how specialists who contribute to a product or improve an existing one involve users in the design process. The CAD software used for this project is AutoDesk Inventor.

In this project, we developed a solution for a multifunctional product used in everyday life, which is useful in any kitchen and meets users' desires and needs. The “Multifunctional 4 in 1” has a compact and elegant design, impressing with its ability to combine four distinct functionalities into a single unit. The microwave oven ensures quick and even cooking of food, while the bread toaster adds a crunchy and flavourful touch to breakfast. The coffee maker provides the aromatic indulgence of freshly brewed coffee, while the sandwich maker allows for the creation of delicious snacks, all in the same energy-efficient device.

3. PRODUCT PRESENTATION

The kitchen is the heart of the home, and efficiency in cooking is essential to make the culinary experience enjoyable and stress-free. An instrument that succeeds in simplifying and optimizing various tasks in the kitchen is the “Multifunctional 4 in 1” product. In this article, we will explore the features and benefits of this ingenious appliance, which combines multiple functionalities to bring a quality culinary experience to every household.

The “Multifunctional 4 in 1” appliance (Figure 5) saves space in the kitchen, bringing versatility, efficiency, and comfort to consumers' homes, thus providing a comprehensive solution for contemporary needs. With its ingenious design and multiple functionalities, this appliance becomes an essential piece in the modern kitchen, contributing to the simplification of daily life and transforming the way we cook.

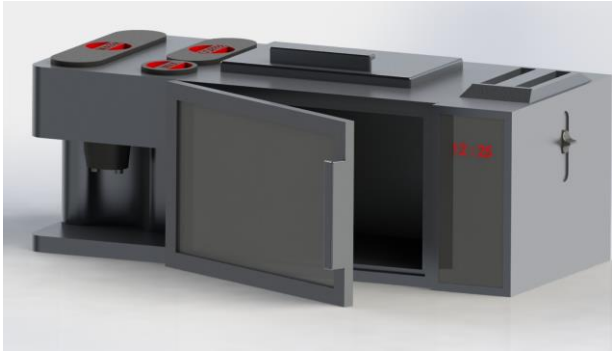

Figure 5 “Multifunctional 4 in 1” Appliance Design

Components of "Multifunctional 4 in 1"

In the modern era, where time and space in the kitchen are precious resources, innovation in kitchen appliances plays a crucial role. The "Multifunctional 4 in 1" appliance, integrating a microwave oven, a bread toaster, a coffee maker, and a sandwich maker, represents a revolutionary solution for the diverse needs of consumers.

The microwave (Figure 6) represents an efficient solution for quick and uniform cooking of food.

The oven features a touchscreen control panel. It provides an intuitive and modern interface, eliminating physical buttons and allowing for simplified and more precise operation of the appliance.

Microwave cooking is known for its energy efficiency and its ability to retain nutrients in food without overcooking them. Thus, users can easily prepare quick and healthy meals, saving time and energy.

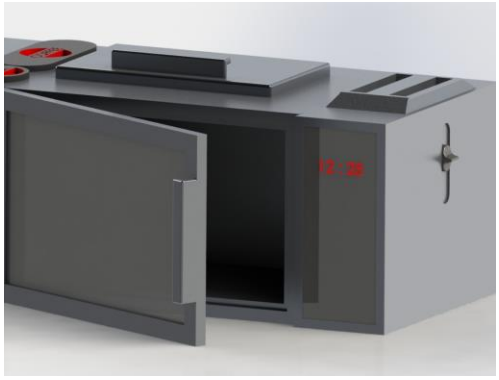

Figure 6 Microwave

The coffee maker (Figure 7) offers the possibility to prepare fresh and aromatic coffee in the comfort of one's home.

The design of the coffee maker incorporates new and innovative features and functionalities such as a digital display, tactile buttons, LED lighting, and other modern elements, providing a more intuitive and pleasant user experience.

The functionality of the coffee maker allows for the preparation of a variety of beverages, from espresso to filtered coffee, thus satisfying the diverse preferences of consumers.

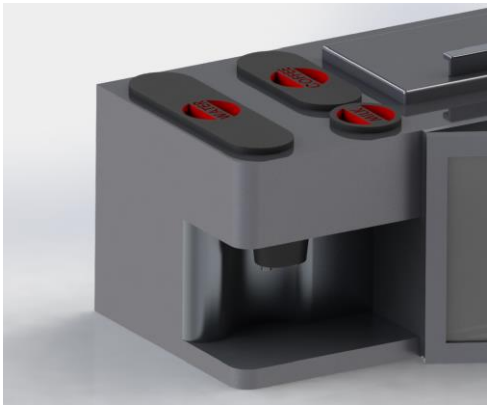

Figure 7 Coffee Maker

The sandwich maker (Figure 8) allows for the preparation of hot and crispy sandwiches in a short time, adding a variety of preferred ingredients. The functionality of the sandwich maker is perfect for breakfast, lunch, or quick snacks.

The appliance features modern technologies such as touchscreen displays, temperature sensors, and preset programs for various recipes. These innovations enhance the user experience and add a futuristic and high-tech aspect to the appliance.

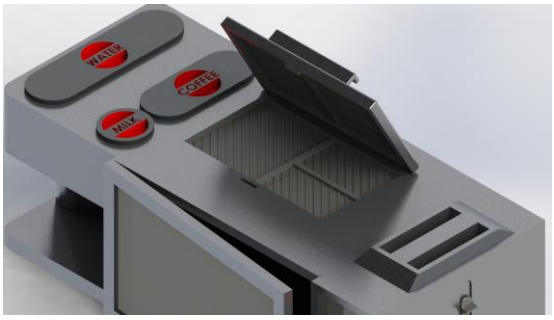

Figure 8 Sandwich maker

The bread toaster (Figure 9) allows users to prepare crispy and delicious toasted bread for breakfast or quick snacks. The bread toaster provides the option to adjust the browning level according to personal preferences, allowing users to achieve the exact desired texture of the bread.

It is a perfect addition to a variety of meals and snacks, offering users more flexibility in the kitchen.

Figure 9 Bread Toaster

By integrating four different functionalities into one appliance, the "Multifunctional 4 in 1" eliminates the need for multiple separate appliances in the kitchen. This reduces clutter on the kitchen countertop and frees up space for other activities or equipment.

The appliance provides a comprehensive sensory experience that combines functionality with aesthetics for a unique and enjoyable experience.

Each component of this appliance is designed not only to fulfil a specific function but also to stimulate the senses of the users in a pleasant and captivating manner. The appliance is elegant and modern, bringing a pleasant aesthetic appearance to the room.

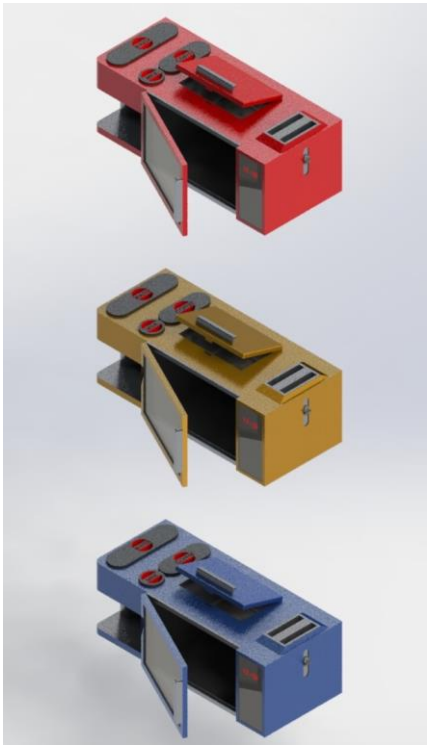

Figure 10 Color options for the "Multifunctional 4 in 1"

The benefits of "Multifunctional 4 in 1"

By integrating four different functionalities into one appliance, the "Multifunctional 4 in 1" eliminates the need for multiple separate appliances in the kitchen. This reduces clutter on the kitchen countertop and frees up space for other activities or equipment.

The appliance provides a comprehensive sensory experience that combines functionality with aesthetics for a unique and enjoyable experience. Each component of this appliance is designed not only to fulfil a specific function but also to stimulate the senses of the users in a pleasant and captivating manner. The appliance is elegant and modern, bringing a pleasant aesthetic appearance to the room.

The simple and intuitive interface makes the appliance accessible to any user, regardless of their level of experience in the kitchen. The multiple functions are easy to access and control, providing a pleasant and stress-free cooking experience.

4. THE ENVIRONMENTAL IMPACT

Currently, there is a growing trend towards sustainability and the use of eco-friendly materials in product design. Manufacturers are focused on reducing carbon footprint by utilizing recyclable or biodegradable materials and promoting sustainability and ecological responsibility.

The "Multifunctional 4 in 1" appliance is not only an innovative device in the kitchen but also a compelling example of how modern technology can harmoniously coexist with the environment. By adopting sustainable materials, energy efficiency, and responsible production practices, this appliance demonstrates that innovation and sustainability can go hand in hand to create products that benefit both consumers and our planet [20].

The essential components of the appliance are made from recyclable and durable materials. The careful selection of these materials contributes to reducing the environmental impact and promotes the responsible use of resources.

With a focus on energy efficiency, the appliance is designed to minimize energy consumption. Advanced technologies used in the microwave oven and other functionalities ensure quick and uniform cooking, saving energy resources and reducing carbon footprint.

In the manufacturing of this multifunctional appliance, processes with reduced carbon emissions are adopted, and waste production is minimized. This approach ensures that the environmental impact during the manufacturing process is kept under control.

The appliance's simple and intuitive interface encourages users to efficiently utilize all functions, preventing food and energy waste. The appliance thus becomes a partner in an eco-friendly and responsible lifestyle.

5. MATERIALS

The essential components of the appliance are made from recyclable and durable materials. The careful selection of these materials contributes to reducing the environmental impact and promotes the responsible use of resources.

The materials used in the production and design of the "Multifunctional 4 in 1" appliance play a crucial role in ensuring the efficiency and quality of this innovative product. In the modern era of technology, material selection is essential to meet the diverse needs of consumers and to create efficient kitchen solutions.

It is important to mention that in the development and production of the "Multifunctional 4 in 1" appliance, aspects related to the durability and sustainability of materials are also considered. There is a focus on using recyclable and environmentally friendly materials, in line with current trends in environmental protection.

To ensure durability and resistance to impacts and scratches, the exterior casing of the appliance is made from materials that are easy to clean and offer a pleasing aesthetic appearance, suitable for various kitchen styles.

The interior of the microwave oven: is made from materials that are easy to clean, heat-resistant, and do not allow the accumulation of dirt and grease.

To ensure uniform heat distribution and efficient cooking of food, the cooking plates are made from durable materials resistant to high temperatures, and their smooth surfaces are easy to clean.

Internal components such as the circuit board, cables, and heating elements are made from high-quality electronic materials. These materials are essential to ensure the proper and safe operation of the appliance.

For components such as baking trays or containers for coffee preparation, heat-resistant materials are used. These materials allow non-stick cooking and are easy to clean.

6. CONCLUSIONS

Innovation in product design is a necessity in a rapidly changing world, where consumer needs and preferences evolve quickly. The "Multifunctional 4 in 1" appliance

exemplifies this innovation by integrating four essential functionalities into a single compact and efficient device.
By focusing on space-saving, energy efficiency, time-saving, comfort, ease of use, as well as cost reduction, this appliance brings significant benefits to consumers in the modern era. Its ability to provide a complete culinary experience in a sustainable and eco-friendly manner adds an additional level of value and relevance.
Furthermore, the integration of durable and recyclable materials in the production of the appliance demonstrates the manufacturer's commitment to protecting the environment and promoting responsible practices within the industry.
Therefore, the "Multifunctional 4 in 1" appliance is not just a useful tool in the kitchen but also an inspirational example of how innovation and sustainability can go hand in hand to create products that bring benefits to both users and our planet. By continuing this trend and adopting innovative practices and technologies, we can contribute to building a better and more sustainable future for all.

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