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Design Innovation Base on Classification Model of Intelligent Products

Zhognjie Xue[1] and Danhua Zhao[2]

[1]School of Design, Hunan University, Lushan Road(s)Yuelu District, Changsha Hunan Province, China
[2]Research Institute of Hunan University in Chongqing, 2-5, 188 Jihuayuan South Road, Longxing Town, Yubei District, Chongqing, China

ABSTRACT

With the development and application of IoT, AI, and Internet technology, traditional products have been transformed into intelligent products with different levels of intelligence and improved human life quality. However, it does not provide a comprehensive and holistic design method for new intelligent products; many new products are produced with the required intelligence but are unable to satisfy the user's requirements. (WEN, 2016). The overall goal of service design is to create a system with experience and design research based on users, technologies, user behaviors, environments, and other aspects of the service. It provides guidance and direction for the design and upgrading of complex intelligence systems. In this paper, we used service design thinking to make intelligent product suggestions for the design process using dependent factors, such as user behavior, technologies, and materials, to determine the best design strategy for the product. We selected the target users, used the user journey map, analyzed the stakeholder's activities, and worked out how to extract user value. Finally, this paper proposes a design process based on service design, which takes into account the value of the different levels of intelligent products and services that are available to the user.

Keywords: Intelligent product design, Design process, Service design thinking, Intelligent level

INTRODUCTION

With the development of intelligence levels, Internet, big data, and other technologies. The IoT have promoted the popularization of smart and internet products. the continuous improvement of our social and economic level, consumer demand for the original inherent product model and function has shifted to experience, commodity circulation into the new retail era. In this context, we first verify our design object thought set factor analysis – the intelligent unmanned retail vehicle. As a complex intelligent product, the intelligent unmanned retail vehicle need to consider three important elements: users' need, technology, and scenario (Figure 1). The current product design method to deal with the challenges of the three elements is difficult to integrate resources to create an intelligent design solution. so this paper in a variety of technical backgrounds, to provide the intelligent level of judgment

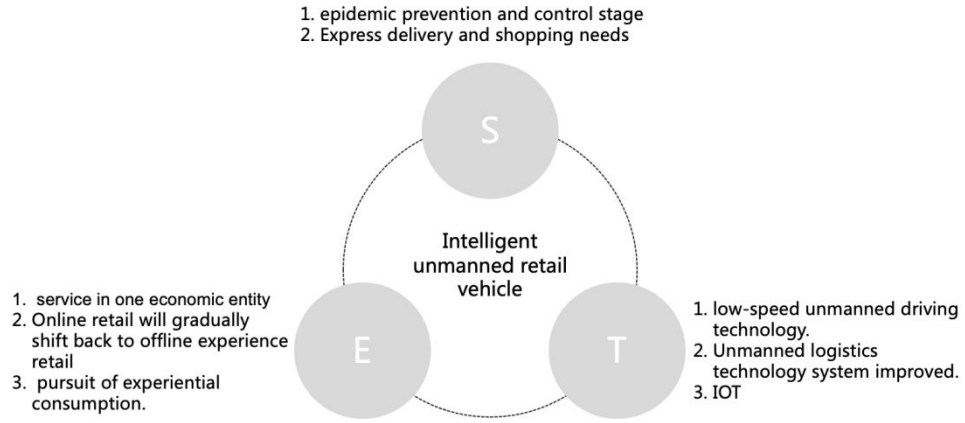

Figure 1: SET analysis to find design opportunities.

to the user-centric integration of user needs; technology; scene of application, and concept design. This paper (1) through service design thinking to determine the multi-stakeholder use of intelligent unmanned retail vehicle needs in different scenarios; (2) from the product opportunity point to intelligent product level judgment, through the demand into the intelligent level, to carry out the judgment to derive intelligent product design across that on hey. (3) applied in practice to integrate design resources and design intelligent unmanned retail vehicles.

SET Factor Analysis

The SET factor analysis method was proposed by Craig Vogel and Jonathan Cagan, which includes the factor analysis of Society, Economy, and Technology (Cagan and Vogel, 2018). First through a comprehensive analysis of the analysis of SET factors to find the product opportunities to find the opportunity—the intelligent unmanned retail vehicle. During the epidemic prevention and control stage, the closed management of the park has brought new problems. Express delivery and shopping for everyday goods have become an integral part of the park, which may bring security risks and management pressure to the park service provider. The park urgently needs a set of intelligent from shopping to delivery solutions to create a safe(non-contact), orderly, technological and convenient smart living area.

CLASSIFICATION OF INTELLIGENT PRODUCTS

Early definitions of intelligent products by Serge A. Rijsdijk and Erik Jan Hultink conceptualized intelligence as a combination of dimensions such as autonomy, adaptability, responsiveness, versatility, cooperativeness, human interaction, and personality, and the range of products that possess one or more of these dimensions. (Rijsdijk and Hultink, 2009) Porter, Me and Heppelmann, define smart products as Intelligent connected products that all share three core elements: physical components (e.g., mechanical and

electrical components); intelligent components (sensors, microprocessors, data storage, controls, software, embedded operating systems, and digital user interfaces) and connected components (ports, antennas, protocols, and networks that enable communication between the product and the product cloud, which runs on a remote server and contains the product's external operating system). (Porter and Heppelmann, 2015) Manuel Holler, Falk Uebernickel, Walter Brenner, believe that Intelligent product is the result of a multidisciplinary intersection, which includes the field of computers, sensor memory program sets, digital systems, intelligent connection systems (sensors), intelligent network systems and proposed a framework for research and development of intelligent products applied to the business sector. (Holler, Uebernickel and Brenner, 2016), T. Novak, D. Hoffman proposed that a Smart Object is a physical device or a collection of devices (Novak and Hoffman, 2019).

In summary, we can see that with the upgrading of technology, the concept of intelligent products while following the iterative development of intelligence products with different capabilities and roles. Intelligent products begin to involve complex operations, users may need to learn how to make them work, it's including mobile terminals, remote control, intelligent panels, and other operations. Intelligent products through various types of sensors to perceive and process, then feedback information to the user, and when it interacts with the user, the intelligent product may show the characteristics of anthropomorphic user interaction will be different if the user communicates with different features and intelligence level of intelligent products.

The most significant distinction between new retail and traditional retail is that the status of merchants and consumers has changed. Users will focus not only product itself, they pay more attention to the service and buying experience. The new retail cart contains a complex series of operations of multiple roles such as producers, managers, and users, especially users and other stakeholders in the process of using the unmanned cart, their behavior is a dynamic change process. Compared with the traditional static process, new intelligent unmanned retail vehicles led to a new challenge full of uncertainty during the interaction process. We hope that through the service design thinking-special analyze user behavior during the usage process to sort out the overall process by multi-user behavior's generation and occurrence, summarize the multi-stakeholder needs into the intelligent level's judgment so that we are able to use new and improving techniques for enhancing coverage accuracy, friendly, and emotional.

We propose to analyze the existing products' intelligence level to derive specific functions to be used and operated by users, and judge and design the intelligence level of the product so that the functions in the intelligent product can be effectively configured and reasonably allocated to form the optimal solution of the intelligent unmanned retail vehicle's structure. Design tasks, the process of design, technical configuration, and the vehicle's structure will be clarified through intelligent level judgment. we identify the primary design goal of each stage in this phase.

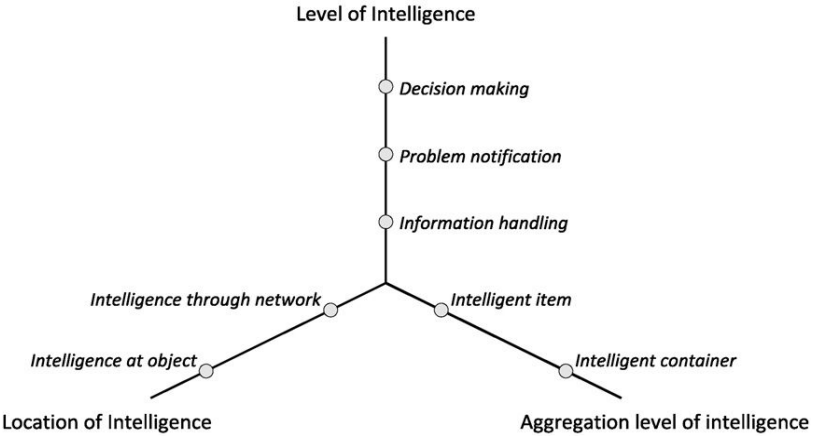

Figure 2: Classification model of Intelligent Products. (Meyer, Främling and Holmström, 2009).

Category of Intelligent Products Based on Classification Model of Intelligent Products

with the development of intelligent products and intelligent industries, products incorporate new technologies and form a complex system during every iteration of the product. the technical manuals and operations standards conflict with user usage and behaviors, they are harder for users to manipulate. At the same time, due to the lack of professional technical knowledge, designers lack experience in conceptualizing technical pathways and assessing technical feasibility during the conceptual design phase (SUN et al., 2020).

Gerben G. Meyera Kary Främlingb et al. developed a classification model for Intelligent products based on three dimensions: Level of intelligence: Information management; location of intelligence: The Aggregation level of intelligence (Meyer, Främling and Holmström, 2009). By classifying the different intelligence levels of intelligent products, designers can retrieve similar design solutions based on the existing design cases and get the basic architecture when designing a complex system of smart products, and then make corrections according to the actual design requirements and finally output the design module (XU and GAO, 2000).

As shown in the Figure 2, Meyer's framework for determining intelligence levels defines:

(1) Level of intelligence: Information management
(2) location of intelligence
(3) The Aggregation level of intelligence

Identifying Intelligent Unmanned Retail Vehicle Infrastructure Through Intelligent Product Classification

From the beginning, the designer can search the classified database before starting the conceptual design phase of the intelligent product, to find a similar technical structure in the database, so as to quickly and effectively find the low-cost technical structure that can be realized, and accumulate the design ideas for the next step.

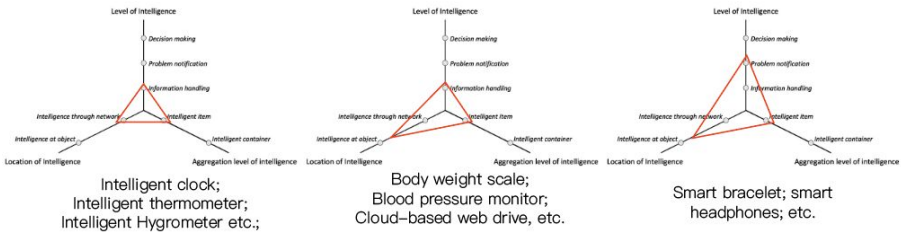

Figure 3: Classification model of Intelligent Products- Personal intelligent products.

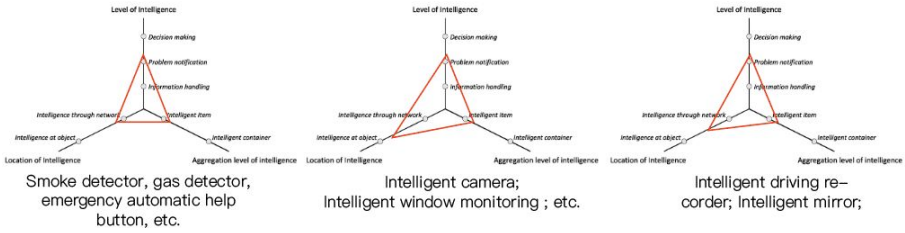

Figure 4: Classification model of Intelligent Products- Intelligent security products.

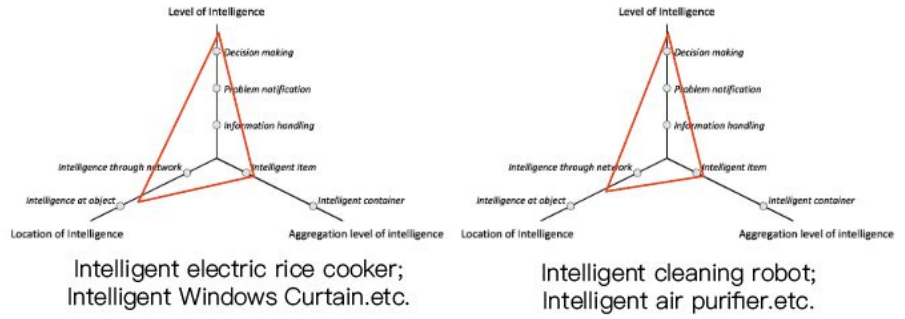

Figure 5: Classification model of Intelligent Products- Home intelligent products.

Personal Intelligent Products (Figure 3)

Personal intelligent products are usually simple intelligent products.

Intelligent Security Products

Intelligent security products (Figure 4) for emergency situations, once the dangerous information is sensed will timely alarm, and product integrated with behavior recognition algorithm, can identify and judge the behavior of people or vehicles in the moment.

Home Intelligent Products

Home intelligent products (Figure 5) have gradually developed from home automation products to the intelligence IoT home intelligent system. The product can sense the environment and dealing with the date,then upload the information to the networks to achieve control of intelligent devices.

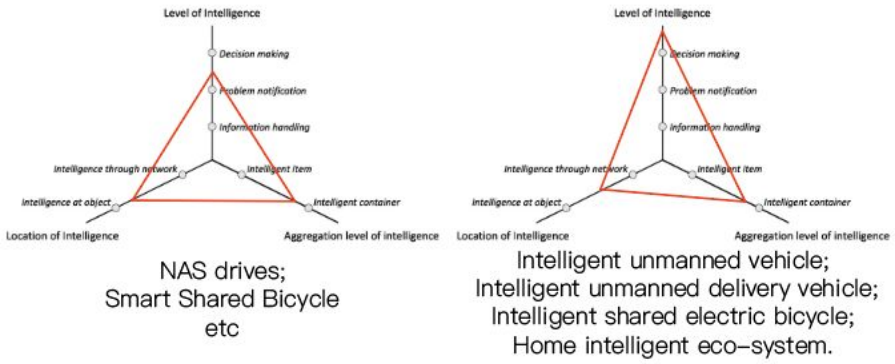

Figure 6: Classification model of Intelligent Products- Shared intelligent products.

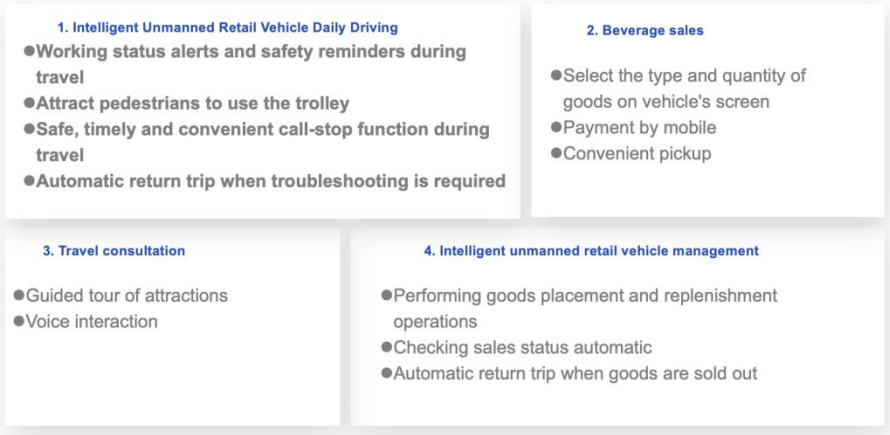

Figure 7: By comparison Classification model of Intelligent Products get the functions of intelligent unmanned retail vehicle.

Sharing Intelligent Products

Intelligent sharing products (Figure 6) generally indica a system of sharing intelligent products. They through the Internet, big data, and cloud technologies, realize products' data exchange. Intelligent Sharing is often in autonomous mode, they send information to the cloud in real-time, and computation and data handing are usually performed in the cloud. Then transport the data to the intelligent product. The cost of this type of intelligent product with new computing way was reduced.

After the analysis, we conclude that intelligent unmanned retail vehicles integrated many different technologies. Intelligent product with the rapid development of technology of communication and internets the intelligent retail vehicle can make decisions through networks and with many information and sharing and the information interactive convenience quick methods and the platforms. Like road facilities, other vehicles, cloud platforms, etc. Through platforms and methods to achieve complex environmental awareness, collaborative control, and other functions.

Figure 7 shows that the Intelligent unmanned retail vehicle has to support a series of complex activities at the system level such as path

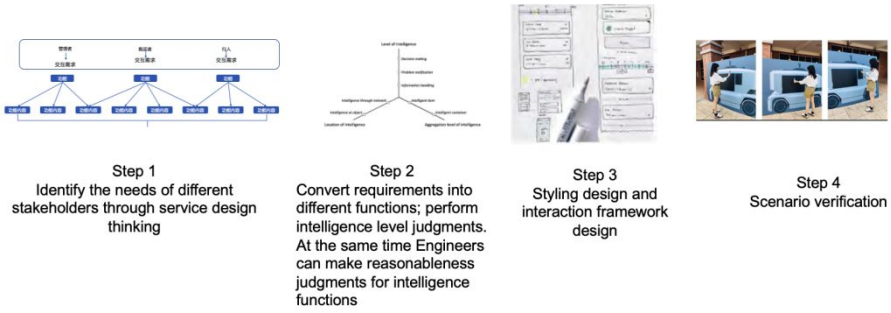

Figure 8: Intelligent unmanned retail vehicle design main processes.

Figure 9: Intelligent unmanned retail vehicle design main processes.

planning, intelligent dispatching, operation management, and purchase activity support.

INTELLIGENT UNMANNED RETAIL VEHICLE DESIGN PROCESS

Based on intelligent products intelligent level judgment framework, the intelligent unmanned retail vehicle's design process will be divided into four main steps as Figure 8 shows.

1) A service system design model for intelligent unmanned retail vehicles is established to build three dimensions— as stakeholder needs, users journeys, and touchpoints (Figures 9 and 10 shows).
   - From a multi-user scenario perspective, a scenario is used to analyze multi-user journeys and gain systematic insight into the user pain points of different users in the scenario; (multi-user part of the service blueprint)
   - From the perspective of a product system
   - From the perspective of multitasking, focus on the scenarios of the user's interaction model.
   - Integrated and applicator with many intelligent interaction technologies
2) Combining the user requirements, the functions of the intelligent unmanned retail vehicle are framed in the intelligent level. At the same time the technical feasibility of the functions under the intelligent level is judged

Functions	Stop by	Interaction with pedestrians on the road				User operation		Pickup area	Pickup method
Design concept	Beckoning	Screen on the side of the vehicle	Voice Interaction	Lights interaction	Stop by beckoning	Mobile	Screen on the side of the vehicle	Right side of the cabin	Open cabin to take out

Figure 10: Intelligent unmanned retail vehicle interaction way.

by the engineering staff. The functions in the intelligent product are effectively configured and reasonably allocated to form the optimal solution of the intelligent unmanned retail vehicle structure concept scheme.

3) Scenario verification in order to rationalize under the complex context and integrate different needs of multi-stakeholder, it's a way to describe and certificate the design objective, the method, the function, and the data flow of the System.

Aggregation Level of Intelligent

The aggregation level of intelligent unmanned retail vehicle depends on the human-computer interaction element, intelligent unmanned retail vehicle and human interaction is mainly divided into three aspects. The consumer's purchase interaction operation respectively: the products selection, input information, and the intelligent unmanned retail vehicle feedback to the user.

Location of Intelligent

The goal of the Intelligent unmanned retail vehicle is to improve the sending of retail goods and the user receiving or purchasing. Therefore, we use RFID tagging on products for tracking and tracing goods, reducing the possibility of missing goods. The intelligent unmanned retail vehicle has both locations of intelligence for the statistical calculation of the number of goods purchased, while with the intelligence through the network to deliver the information to the central processor in real-time, and through network computing, derive the path planning to arrange the replenishment of goods during transportation.

Level of Intelligence

The routine of intelligent unmanned retail vehicles: route planning, dealing with obstacles, and a series of other driving tasks require intelligent unmanned retail vehicles to have the ability to collect information, make judgments and ultimately make decisions. Intelligent unmanned retail vehicles need to interact with passersby on the road in real-time to attract their attention and serve as a safety alert for pedestrians with vehicles approaching. A higher intelligence level can help the vehicle make different voice and expression feedback in different scenarios, thus giving the user a new experience.

During the design process, the analysis method of usability in engineering is a better way to obtain the validity of the design. The project is based on the chassis of the existing unmanned slow trolley and the design of the exterior

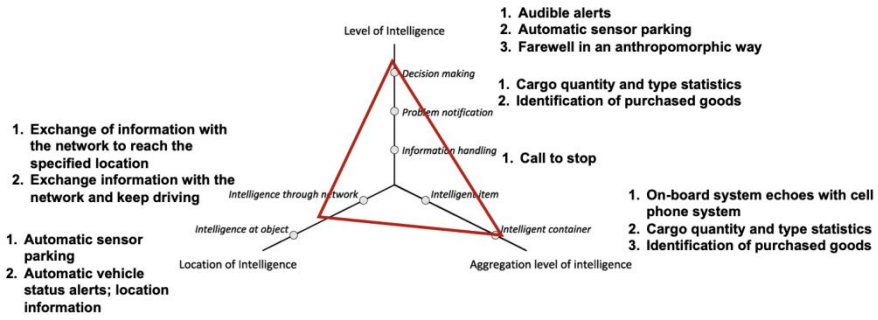

Figure 11: Intelligent unmanned retail vehicle design main processes.

Figure 12: Intelligent unmanned retail vehicle scenario design validation.

Figure 13: Intelligent unmanned retail vehicle styling design.

of the intelligent unmanned retail vehicle with retail function added to the architecture, after proposing the intelligent level function distribution map (Figure 11) and communicating with the technical engineering department several times, the structure finally was been determined.

Intelligent Unmanned Retail Vehicle Styling Design

The intelligent unmanned retail vehicle with simple visualization elements can directly achieve the purpose of functional priority while allowing users to feel the intelligent semantics involved. We separated the carriage and cabin to satisfy engineering requirements. The storage refrigerator is located on

the side of the vehicle, users and administrators can easily take and manage goods by opening the door (Figures 12 and 13). And the front screen uses a long bar screen to display the selling information of the Intelligent unmanned retail vehicle and anthropomorphic expressions hoping to give the feeling of a pedestrian on the road.

CONCLUSION

As intelligent products in the Internet of Things environment gradually enter our daily life, the lifestyle of people is also affected to a certain extent. People prefer to make intelligent products become life partners instead of using tools to enhance the experience through intelligent products rather than just satisfying the needs, therefore, how to make intelligent products more humane and easier to understand so as to better serve people is a problem that designers should consider. Intelligent product level classification has an irreplaceable role as a tool to express, explore, test, and evaluate intelligent product design. With the development of technology and the continuous emergence of various platforms, we analyze stakeholders' behavior through service design thinking, find design opportunities, and build Intelligent product functional prototypes through the intelligent classification framework, while technical personnel makes judgments in a way that will be increasing, reasonable and effective. The method of building intelligent classification under the hierarchy can assist designers to get rid of the shackles of technology and means of implementation and considering the relationship between intelligent products and people, society and environment in a broader perspective in design.

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