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The Smart Servicescape Framework in Smart Home Healthcare Service Experience

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The dramatic advancement of Internet of Things technology and smart services has encouraged the integration of smart home and healthcare service. Despite various researches on the technology of smart home healthcare services, it is essential to approach those services from the service experience perspective. Moreover, it would be significant to consider the context and environment of smart services, namely "smart servicescapes," as they can influence users' perceptions and experiences. With this background, the aim of this study was to examine the smart servicescape framework that was developed based on the smart home services in the prior study from the domain of smart home healthcare services and to ameliorate the framework to better reflect the characteristics of smart services.

During the qualitative analysis of 21 user-scenario movie clips on the smart home healthcare services, the smart servicescape elements were re-categorized and relabeled, and the structure of smart servicescape framework was modified. The values of the improved smart servicescape framework can be identified in two aspects. First, the framework can demonstrate the characteristics of smart services, namely the omnipresence of Datascape *and* Connection infra *and the mediating role of* Artificial intelligence*. Second, this framework can be used to establish design requirements about service elements, relationships, and interactions when the smart service experiences, including the smart home healthcare, are designed.*

Keywords*: Smart servicescape, Smart home healthcare, Service experience, Service design*

Introduction

Smart services have been rapidly developed with the innovation of information and communication technologies (ICTs) such as ubiquitous computing and the Internet of Things (IoT). Particularly, various B2C smart services such as the smart health, smart home, smart learning, smart media, and smart cars have started to permeate people's daily lives. Consequently, the questions of how to adopt and apply the smart services and how to utilize them in an effective and natural way have become underlined. Nevertheless, academic research regarding smart services has not expanded at the same rate as the proliferation of smart services (Wuenderlich et al., 2015). The focus of previous research has largely been on how to develop and apply smart service technologies in the engineering research, since the smart services are inherently technology-intensive (Wang & Song, 2017). On the other hand, the service management research has investigated mostly the acceptance and usage intention of smart services (Canhoto & Arp, 2017). However, smart services have scarcely been investigated from the viewpoint of service design and service experience.

A perspective of service experience has been initiated academically in the service management research. In this field, the importance of service context and service environment has been highlighted, since the service interactions and the service provision take place in those context and environment (Akaka & Vargo, 2015). Normally, service is provided through direct or indirect interactions between customers and service providers—that is, service encounters (Surprenant & Solomon, 1987). Individual customers tend to be led to different service outcomes due to their varied past experiences and preferences as well as probable differences of service providers; thus the service encounters have been underscored in terms of diversified service interactions (Bitner, 1990). Moreover, the physical and social environments where these encounters take place—namely, the servicescape—can influence the different ways in which the customers experience a service (Bitner, 1992; Rosenbaum & Massiah, 2011). Therefore, to consider the service experiences, the phenomenological and social structural perspectives are

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needed, since they could influence the whole service experience (Akaka, Vargo, & Schau, 2015). In that sense, Akaka and Vargo (2015) claimed that the service context where service experiences are created is composed of the service encounters and the servicescape.

In the same way, when smart services are approached from the viewpoint of service experiences, they require the consideration of the context and environment of smart services—that is, the "smart servicescape" (Kang, Kwon, Kim, and Park, 2017). Because of the convergence of online and offline contexts in the connected environments of smart services, the smart servicescape has different characteristics from traditional servicescapes. In other words, intelligent objects and environments communicate continuously with users, and data are collected in the real time based on advanced network technology (Allmendinger & Lombreglia, 2005). However, research has not yet been conducted about the environmental dimensions of smart services—namely, the smart servicescape.

Kang et al. (2017) have proposed a framework for the smart servicescape, which we established from the cases of smart home services. Now, it is necessary to expand the target research area and to investigate whether the framework could be applied to other kinds of smart services—particularly to the smart home healthcare service, which is a more extended form of smart home service involving the healthcare service.

Therefore, the aim of this study is to examine the framework of the smart servicescape from the perspective of smart home healthcare service and to investigate the direction in which the framework should be improved so that it is able to involve the characteristics of smart home healthcare. In accordance with this research aim, the article consists of the following structure. The literature review starts by addressing the smart home healthcare service and exploring its characteristics to generate the service experiences. Then, we introduce the smart servicescape framework that we developed in a prior study, and describe the dimensions in detail. It is followed by the research method describing, including the process of examining the framework by focusing on the cases of smart home healthcare service. The result of the improved framework for the smart servicescape is illustrated with the findings. A conclusion and discussion section includes the study's contributions and limitations.

Literature Review

Smart Home Healthcare Service Experience

The dramatic advancement of IoT applications in gerontechnology has encouraged the integration of smart home with technologies related to assistive living and E-health or M-health (Majumder et al., 2017). E-health employs ICT to automate and digitize healthcare processes and information, so the health information and medical histories of patients can be stored as electronic medical records (EMRs) or electronic health records (EHRs) (Varshney, 2009). Authorized personnel such as family doctors, caregivers, or staff of emergency medical services (EMSs) can access these records. With the advancement of portable devices (e.g., smart phones and tablets) and mobile communication technologies, the concept of E-health has evolved toward M-health, which allows high-speed data transfers regardless of time and space and connect people with the central healthcare system (Majumder et al., 2017).

These technologies have accelerated the realization of remote health monitoring systems. Long-term health monitoring and early detection is critical in preventing chronic diseases, which are among the most usual and costly health issues (Centers for Disease Control and Prevention, ?). Moreover, Majumder et al. (2017) characterized the home-based remote health monitoring system as follows.

> *Remote health monitoring allows un-obtrusive, ubiquitous, and real-time monitoring of physiological signs without interrupting the daily activities of individuals. People can remain in their familiar home environment and enjoy their normal lives with the friends and family while their health is being monitored and analyzed from a remote facility based-on the physiological data collected by different on-body sensors. The system can perform long-term health trend analysis, detect anomalies, and generate alert signals in the case of an emergency (p.5).*

In this way, the smart home healthcare service has typical aspects, such as the long-term health monitoring and the continuous connection with authorized healthcare personnel (e.g., caregivers, family doctors, healthcare centers, EMSs). Therefore, the great involvement of healthcare service providers and healthcare systems is a distinguishing characteristic of smart home healthcare services when they are compared to general smart home services.

The issue involves recognizing the importance of service environments, namely the servicescape, when designing the smart home healthcare service experiences. As noted in the Introduction, service experiences are generated in service context, and it can directly influence the user's perception and satisfaction regarding the smart home healthcare services. Since the service encounters and servicescape produce the service context, the servicescape can influence the user's service experiences in both direct and indirect ways. In other words, we can achieve the design of invisible service experiences through the sum of the service contexts generated from the servicescape elements. Therefore, the establishment of a framework through the investigation of the smart servicescape elements would be valuable to further the design of the smart service experiences.

Smart Servicescape Framework

As explained in the Introduction, Bitner (1992) established the concept of the "servicescape" as a manmade physical and social environment in which service encounters are framed. The service context was expanded with the concept of the servicescape from the firm-customer interactions toward the user-environment relationships. She accentuated the effects of physical environments and classified these environments into three dimensions: (1) ambient conditions (circumstantial attributes such as temperature, air quality, noise, music, odor, and so on); (2) space and function (the arrangement/layout of the machinery, equipment, and furnishings); and (3) signs, symbols, and artifacts (visible communicators on the exterior and interior). Since then, the servicescape categorization has been investigated in various service sectors such as the restaurant, leisure, and hospitality sectors (Lin, 2004; Ryu & Jang, 2007; Wakefield & Blodgett, 1996). Moreover, it was proposed that the "social servicescape" involves social or non-commercial relationships (e.g., indirect interactions with other customers, social density, the need for connectedness, and direct interactions with service providers) (Rosenbaum & Massiah, 2011; Tombs & McColl-Kennedy, 2003).

Founded on the notion that a servicescape embraces both physical and social aspects, Kang et al. (2017) proposed a framework for the smart servicescape, as shown in Figure 1. The framework was initiated from the service experience blueprint—which encompassed the studies of Bitner, Ostrom, and Morgan (2008) as well as Patrício, Fisk, and Falcão e Cunha (2008). The components of the service experience blueprint were service encounters (i.e., a series of customer actions), the physical servicescape (i.e., physical evidence), visible frontstage interactions, invisible backstage actions, and the social servicescape, which could be infused with the viewpoints of service experiences (i.e., service encounters and the servicescape). Analyzing the cases of smart home service experience, we adjusted the framework for the smart servicescape so that it would identify new dimensions that could include the characteristics of smart services:

- *Smart device* was positioned as a separate dimension instead of a sub-element (e.g., equipment) in the space dimension.
- *Datascape* was newly added to reflect the key characteristics of smart services (i.e., real-time data collection and the continuous data exchange of intelligent objects).
- *Connected scape* was also added to explain the network infrastructure, which enables the smooth function of *Datascape* (Kang et al., 2017, pp.1673).

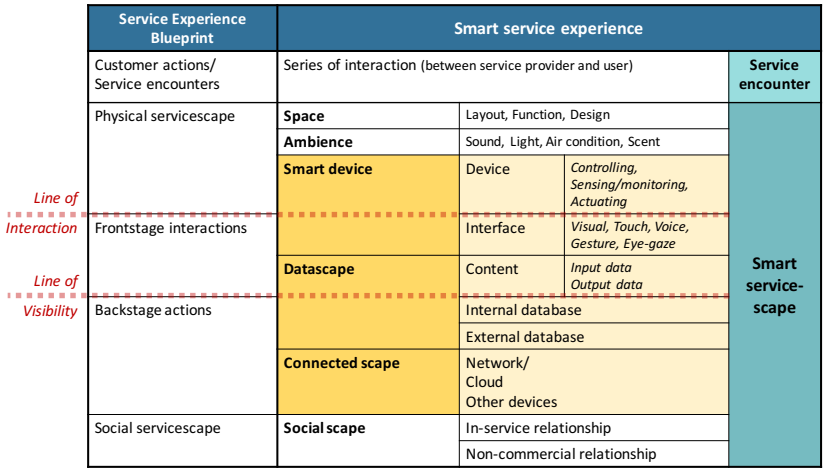

Figure 1 A framework for the smart servicescape that is matched with the service experience blueprint. Source: Kang et al. (2017, p. 1672)

However, this framework had several limitations in fully demonstrating the smart service properties—such as real-time connectedness; the ubiquitous data collection; and communication among users, smart devices, and environments (Hoffman & Novak, 2015; Ng & Wakenshaw, 2017). Consequently, the *Datascape* and *Connected scape* would be omnipresent in the service context, and they could influence and be influenced by *Smart devices, Space, Ambience*, and *Social scape*. Accordingly, the line of interaction or the line of visibility might not be clearly distinguished in reality. Hence, to improve the limitations, we will examine the smart servicescape framework through the expansion of the range of smart service domains—in this study, the smart home healthcare service.

Research Method

The infusion of smart technology into healthcare services is still in progress, and the ideal scope of smart home healthcare services is not yet prevalent in people's daily lives. Therefore, to observe users' experiences of smart home healthcare services, certain kinds of simulated circumstances or scenarios would be necessary. Instead of simulated environments, we used YouTube™ to view 21 scenario-portraying movie clips, which were released through the official channels of ICT corporations—such as Philips, Samsung, IBM, Intel, Microsoft, and so on—that have been developing smart home healthcare services. We listed the referenced movie clips in Table 1.

Table 1 The list of referenced movie clips regarding smart home healthcare services

#	Publisher channel	Date of publication	Title of video
1	Samsung	2016. 11. 29.	Home care Samsung healthcare solution
2	Samsung	2016. 11. 29.	Personal care Samsung healthcare solution
3	Samsung	2018. 1. 30.	How virtual visits and VR are changing healthcare
4	Samsung	2016. 12. 25.	Lumini
5	Philips	2016. 5. 27.	Philips CareSensus- new senior home monitoring platform
6	Philips	2017. 1. 17.	MeCare looking after you at home
7	Philips	2012. 3. 20.	Bringing healthcare home: complex sleep apnea
8	Philips	2014. 10. 2.	Philips Minicare Home monitoring aims to improve patients' quality of life during chemotherapy.
9	Philips	2016. 10. 3.	Philips' ecosystem of connected health devices
10	Intel	2017. 4. 27.	The future of healthcare technology
11	IBM	2015. 5. 20.	How it works: IBM Watson Health
12	IBM	2013. 7. 5.	Big data & analytics for healthcare
13	IBM	2012. 6. 4.	IBM healthcare Industry: 2020 Vision
14	IBM	2015. 4. 13.	IBM Watson Health and the future of healthcare
15	Microsoft	2017. 3. 16.	Office 365 virtual health templates
16	Microsoft	2017. 2. 21.	Healthcare in 2017: Transforming medical care
17	Microsoft	2011. 10. 24.	Health future vision
18	Apple	2016. 3. 21.	ResearchKit - Empowering doctors, researchers, and now you
19	Aifloo	2015. 4. 9.	Aifloo Smart Care
20	AXA	2015. 11. 30.	Future of technology in healthcare
21	PwC	2017. 11. 22.	Exploring the future of healthcare

First, we watched the movie clips to gain a consensus about the service level of smart home healthcare. Then, we developed a representative service-usage scenario to include the various service experiences illustrated in the movie clips. We considered two situations—namely, a normal health monitoring case and an emergency case—and we specified detailed steps for normal and emergency situations. For example, the normal health monitoring situation consisted of steps such as (1) the measurement of the user's health status, (2) the continuous monitoring of the user's health status, (3) the notices and counsel regarding one's health problems, (4) the diagnosis of one's health problems, and (5) the treatment and further solutions of one's health problems. Moreover, we subdivided each step into service encounters—namely, the series of interactions. For instance, we subdivided the phase of "the measurement of the user's health status" into "the delivery of a smart health-check device," "setting the device," "using/wearing the device," and "measuring one's health status." The emergency situation also followed the steps above, but we differentiated the detailed service encounters in accordance with the emergency cases.

We tuned the steps and service encounters repeatedly during the review of the referenced movie clips. Next, we utilized the smart servicescape framework, which was developed in the prior study (Figure 1), as an initial analytic framework. We allocated the content items observed from the movie clips according to the service usage scenarios, and we iterated the addition, relocation, combination, and relabeling of the contents and framework categories to make the framework more appropriate for the smart servicescape. Consequently, we developed a service experience blueprint of the smart home healthcare service in the cases of normal health monitoring and an emergency, as illustrated in Figure 2. Moreover, to solve the limitations that emerged during the analysis process, we established the improved version of smart servicescape framework, as exhibited in Figure 3. Figure 4 shows a

sample scenario of smart home healthcare service—particularly the normal health monitoring case, which we represented by applying the improved framework.

Result

During the qualitative analysis intended to categorize the observed items according to the initial analytic framework, we identified several modification points for improving the initial framework.

First, we divided the *Smart device* into the categories of sensing/monitoring, reasoning, and actuating parts, according to Cook, Augusto, and Jakkula (2009) categorization of ambient intelligence technologies. Particularly, the reasoning part is about the function of data processing. It is not necessarily a physical part of the smart device with which a user directly interacts, but it could be connected with the smart device through a network. Thus, this study named the reasoning part of data processing as *Artificial Intelligence* following the notion of Russell and Norvig (2002).

Second, we had defined the *Datascape* as the content (input/output data) and database (internal/external) in the initial framework. However, the input data is normally the primary data that has been gathered from the sensing/monitoring part of smart devices, and the output data is usually the secondary data that has been analyzed and processed by the *Artificial Intelligence*. Moreover, the primary and secondary data can be considered as an internal database that is thus personal and customized, while an external database would be distinguished from the internal one through elements such as weather or dietary information data. Hence, this study divided the *Datascape* into the categories of the primary database, secondary database, and external database.

Third, we had defined the *Social scape* as an in-service relationship and non-commercial relationship in the initial framework. To clarify each meaning, we introduced the phrases *Service relationship* and *Social relationship* to refer to the above terms, respectively. The role and involvement of the *Service relationship* are more accentuated in the smart home healthcare services than in the smart home services. Healthcare service providers such as homecare agency staff, family doctors, pharmacists, health trainers, or nutritionists regularly monitor and check the health statuses of users. Users can communicate directly or indirectly with those service providers in the form of online or real-time counsel.

Fourth, we re-labeled the *Connected scape* as the *Connection infra* to clearly designate the infrastructure of the network and Cloud.

Consequently, we established the service experience blueprints of two situations (i.e., normal health monitoring and emergency), as shown in Figure 2.

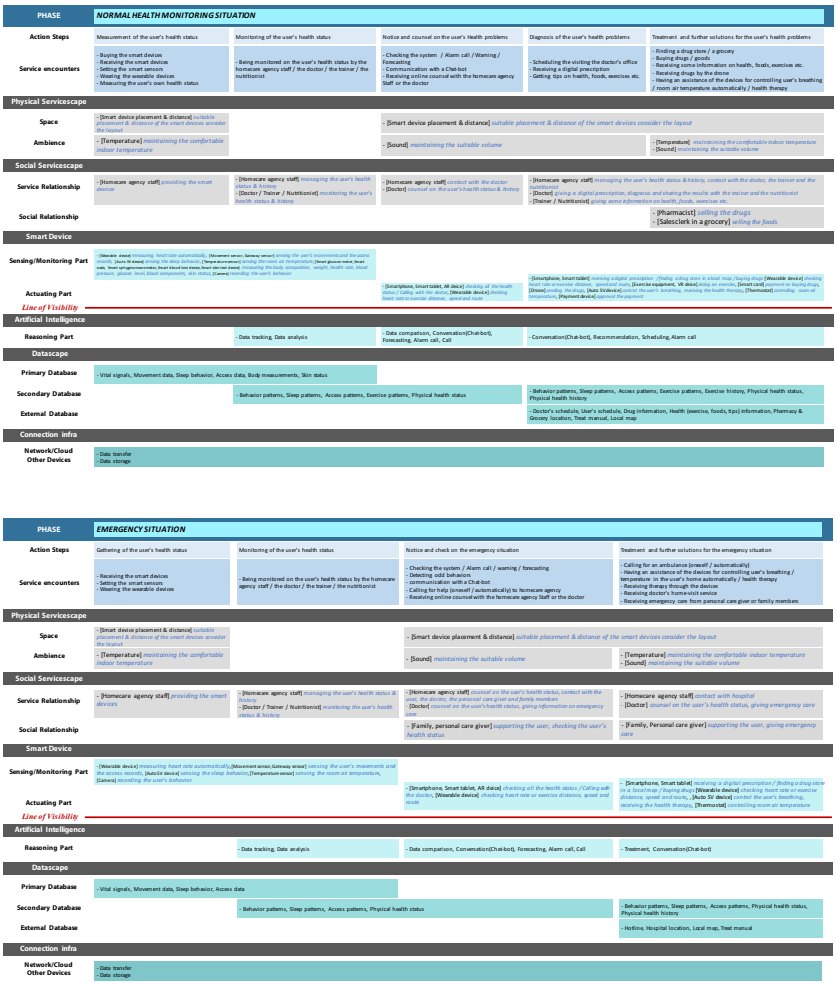

Figure 2 Service experience blueprints of smart home healthcare services (top: normal health monitoring situation; bottom: emergency situation)

Furthermore, we improved the structure of the smart servicescape framework to reflect the smart service characteristics, as illustrated in Figure 3. The *Datascape* and *Connection infra* would be pervasive in the service context, and they could influence and be influenced by *Smart devices, Space, Ambience*, and *Social scape*. Moreover, the *Artificial Intelligence* could be considered to have a mediating role between the perceptible servicescape (i.e., *Smart device*, *Space*, and *Ambience*) and the *Datascape* through a network (i.e., *Connection infra*), because it could process the data collected from all environmental elements and compile them into databases. Particularly, the *Artificial Intelligence* (i.e., reasoning part) is directly connected to the *Smart device* (i.e., sensing and actuating parts) in that they constitute the ambient intelligence technologies (Cook et al., 2009).

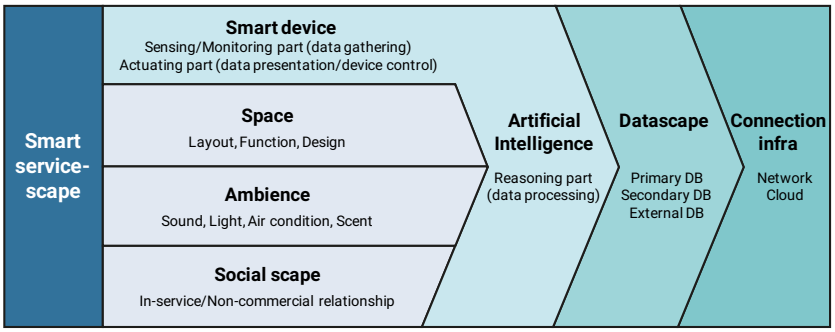

Figure 3 An improved framework for the smart servicescape

In accordance with the improved framework for the smart servicescape, we created an example scenario of the smart home healthcare service experience in the normal health monitoring situation and represented it in Figure 4.

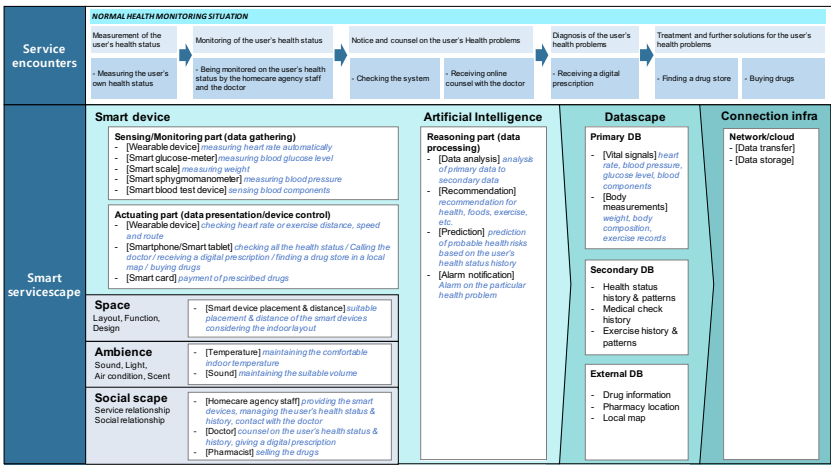

Figure 4 An example of the smart home healthcare service scenario examined with the smart servicescape framework

Discussion and Conclusion

With the rapid growth of smart services, it became significant to approach smart services from not only the technology perspective but also the service experience perspective. In line with the experience viewpoint, it would be essential to consider the environment and context of smart services, since the service environments—namely the "smart servicescape"—fundamentally influence users' perceptions of service quality and experience. With this background, we aimed to examine the framework of the smart servicescape from the domain of smart home healthcare service to improve the prior version of framework so that it better reflects the characteristics of smart services.

During our qualitative analysis of 21 user-scenario movie clips regarding the smart home healthcare services, we improved the smart servicescape framework in several ways. First, we divided *Smart device* into the subcategories of sensing/monitoring, reasoning, and actuating parts— following the categorization of ambient intelligence technologies. Second, we re-classified the *Datascape* as the primary, secondary, and external database. Third, we re-labeled the *Social scape* as service relationship and social relationship. Particularly, we emphasized the role and involvement of the service relationship more in the smart home healthcare services than in the general smart home services; the engagement of healthcare service providers (e.g., homecare agency staffs, doctors, pharmacists, health trainers, or nutritionists) in service processes and their communication with users are frequent and personalized depending on the user's health status.

The values of the smart servicescape framework can be recognized in two aspects. First, the framework can illustrate the characteristics of smart services—namely, the omnipresence of *Datascape* and *Connection infra*— and the mediating role of *Artificial intelligence* between the perceptible servicescapes (i.e., *Smart device, Space,*

Ambience, and *Social scape*) and the imperceptible *Datascape.* Second, this framework can imply design requirements regarding the kinds of service elements that should be considered in various types of relationships or interactions. The design of invisible service experiences can be achieved through the sum of service contexts designed with both the perceptible and imperceptible servicescape elements. Therefore, the establishment of a framework through the investigation of the smart servicescape elements would be valuable in further designing the smart service experiences—in this study, the smart home healthcare service experiences as in this study.

Still, some limitations have been identified in the improved framework. The smart servicescape elements in the framework could be appropriate for demonstrating the component perspective of service contexts, but they have challenges in explicating detailed interactions and interfaces among the components. Therefore, the interactions and interfaces need to be supplemented in the form of additional layers—as Amiribesheli, Benmansour, and Bouchachia (2015) studied. In other words, the framework of the smart servicescape could be suitable for the perspective of service context components, but from the perspective of service experience, the layered structure for the smart service could be more explicative. Hence, to resolve this limitation, further research is in progress to improve the smart servicescape framework by adopting the layered structure of smart services.

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