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Service design for intelligent parking based on theory of inventive problem solving and service blueprint

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ABSTRACT

This study refines a structural service design stages based on the Theory of Inventive Problem Solving (TRIZ) and the service blueprint approach. This study uses the case study of intelligent parking services with the mobile application technology and vehicle license plate recognition system in a high-end shopping mall. In the problem definition stage, the research analyzes the enterprise problem. In the service resolution stage, the TRIZ contradiction analysis and the service blueprint of the parking service as it existed is depicted from the principles of problem resolution. In the solution evaluation stage, new intelligent parking mobile applications (apps) are proposed following the principles generated in the second stage. Furthermore, the failure points and waiting points in the prior service blueprint are overcome and the new service performance is significantly improved. It contributes to enriching the service design literature, and extends the range of TRIZ applications for future parking technology.

1. Introduction

Service innovation plays a critical role in bringing competitive advantage under the severe competition circumstance with dynamic customer requirements in the services sector [34,6]. How enterprises develop new services is an important research topic in service innovation and service design [21,23,5]. From a business perspective, ICT (information and communication technology) provides the possibility to re-arrange the business processes, making it possible to be more flexible and more efficient while facing the uncertainty especially in the intangible service sector [13,37,43].

A convenient traffic environment and associated external transportation are the key success factors for a shopping mall. A good shopping center must provide good car and motorcycle parking space, in order to meet customer demand for parking. The parking lot entrance should also be planned properly and carefully to avoid affecting traffic. Therefore, the metropolitan shopping centers should pay more attention to parking service design.

In response to customer demand for parking, the parking lot industry is already equipped with advanced ICT-based automation management solutions. Through internet-centralized digital management, with such innovations as digital monitoring and recording, license plate recognition, automatic payment kiosks, the parking manager can have detailed operational information about the parking service to provide a safer and more refined parking service. However, there are still many customer complaints in some particular parking situations at different locations. Therefore, to improve service quality and optimize customer parking experience are still key goals for innovation. Since Taipei 101 Mall has both retail shopping and tourism functions, the parking service management is considerably more complicated than others. Although its parking lot already adopted ICT-based automation management solutions, the complaints about parking are still the most frequent complaints of all. Therefore, this study takes Taipei 101 Mall as an empirical case as it develops a new intelligent parking service system.

The frequent complaints about the parking service include difficulty in finding the entrance of the parking lot, easily confused staff-only and customer-only parking spaces, difficulty in finding the mall entrance after parking, difficulty in finding a parking space, the parking discount obtained by shopping is not integrated with the automatic parking payment system, no directions to the closest elevator to the parking space, difficulty in finding the car when going back to the parking lot, and no instruction to the entrance or exit to desired direction. Taipei 101 Mall has tried to resolve these problems.

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Based on the above issues and the advantages of ICT-based service innovation, 101 Mall wanted to develop a new parking service using ICT technology. This study uses service design based on the TRIZ method to analyze the parking principles and direction of improvement. In addition, the service blueprint method was used to depict the case company's prior service and new service in order to achieve effective design, implementation and control of new services. In this paper, the new mobile apps for intelligent parking services were actually analyzed and designed for Taipei 101 shopping mall and were implemented in June 2013.

The remainder of this paper is organized as follows. Section 2 presents the research method literature of TRIZ and service blueprint. In Section 3, the paper describes and analyzes the parking situation and deficiencies of case company. In Section 4, the paper analyzes the root cause and the context of the problems of the former service blueprint in the problem definition phase. The research describes mobile apps used by 101 Mall to develop new services in the problem resolution phase. In the solution evaluation stage, the paper also discusses the new intelligent parking services provided by the mobile apps system, and the empirical benefits compared with previous practices. Then the conclusion is made in Section 5.

2. Literature review

This study adopts a TRIZ-based method and service blueprinting as the service design method for the case. The TRIZ-based method allows the design of new and inventive services focusing on solving business problems with non-experiential domain background using the knowledge base [2,42]. Service blueprinting can be used to analyze the detail process to handle the business context and make sure to generate the adequate parameter of TRIZ. Moreover, service blueprinting is helpful in establishing a complete service model and setting out individual service responsibilities in the service system [32]. With a complete service blueprint, the personnel can understand the process of each service and realize the correlations between their part of responsibilities and the other parts of the service system. With a complete service blueprint, the management can examine possible errors in processes through the entire blueprint, and improve or conduct a service design [12]. Therefore, service blueprinting is an important method for service design in industrial fields. In this Section, we summarize literature of service design based on TRIZ and service blueprinting methodology.

2.1. Service design based on Theory of Inventive Problem Solving (TRIZ)

Service design is the first step towards new service development (NSD) [31,30,11,35,20]. It visualizes the phenomena, enabling services to be given their proper position in the service-oriented market context [41]. The difference between service design and new service development is that service design must depict the detailed structure, content and process of the service [29]. As can be seen from the literature, NSD refers to an entire process of developing new services from idea generation to market launch. Service design is the front end of the whole process [30].

TRIZ is a problem-solving analysis and forecasting tool derived from the study of patterns of invention in the global patent literature [14]. In R&D, or the innovation phase, staff often encounter problems when trying to improve a product or engineering characteristics, but other product or engineering characteristics deteriorate. The elimination method was adopted in TRIZ to overcome such trade-offs [36]. Altshuller [1] analyzed and summarized 39 frequently-encountered engineering parameters of technical contradiction. These 39 engineering parameters can be used to define problems (see Appendix A). These parameters can create a 39X39 contradiction matrix as shown in Table 1. R&D personnel can check the matrix to find the principles that can be used in TRIZ when their inventions have contradictory elements. Altshuller also summarized 40 principles of invention (see Appendix B) from these patents, corresponding to the contradiction matrix. When using the contradiction matrix, the top row of the matrix shows the worsening parameters and the left-most column lists the improving parameters. The numbering of the 40 principles to resolve contradictions corresponds to the cell of the contradiction matrix as shown in Table 1. For reasons of space, only part of the contradiction matrix is shown in Table 1.

The TRIZ approach is widely used in the engineering and technical field for R&D and in the designing for tangible goods. However, there are more researchers focusing their research attentions on applying TRIZ in non-technical areas, such as management and the service innovation in recent years. Zlotin et al. [40] first systematically review the field that applied TRIZ in non-technical cases. The applications include art, medicine, biotechnology, business, organization, management, and political campaign. On the other hand, Mann [24], Mann [25] find 31 suitable business and management parameters based on TRIZ theory and enterprise cases. Marsh et al. [26] develop corresponding 31 educational parameters, and builds contradiction matrix to solve the conflict when designing innovation based on Mann [24] study. Zhang et al. [38], Zhang et al. [39] apply the concept of TRIZ in service operations management and modify the original TRIZ 40 principles of engineering innovation to make it suitable for the service sector. Dourson [8] re-interprets TRIZ40 innovative principles to fit the financial industry. Jiang et al. [18], Jiang et al. [17] describe why traditional engineering parameters used in service sector exists gaps, and develops service parameters to adapt TRIZ for service system design. Retseptor [27], Retseptor [28] explore new TRIZ applications innon-technical fields, such as quality management [7,27] and customer satisfaction. Shahin and Pourhamidi [33] apply TRIZ-based service design in hospitality industry so asto improve the quality of designing new services. Lee et al. [19] use TRIZ-based service design approach to develop new location-based

Table 1
Partial TRIZ contradiction Matrix.

Improving parameter	Worsening parameter					
	1. Weight of moving object	2. Weight of stationary object	3. Length of moving object	4. Length of stationary object	...	39. Productivity
1. Weight of moving object	N/A	N/A	15,8,29,34	N/A	...	35,3,24,37
2. Weight of stationary object	N/A	N/A	N/A	10,1,29,35	...	1,28,15,35
3. Length of moving object	8,15,29,34	N/A	N/A	N/A	...	14,4,28,29
4. Length of stationary object	N/A	35,28,40,29	N/A	N/A	...	30,14,7,26
⋮	⋮	⋮	⋮	⋮	⋮	⋮
39. Productivity	35,26,24,37	28,27,15,3	18,4,28,38	30,7,14,26	...	N/A

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