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ADVANCES IN GLOBAL SERVICES AND RETAIL MANAGEMENT

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The Coverage of AIOT Based Functional Service: Case Study of Asian Futuristic Hotel

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Abstract

The combination of Artificial Intelligence and Internet of Things (AIOT) have been developing as a prevalent technology for applications in many industries and buildings. This research deliberately chooses a leading hotel in the application of automation to examine the coverage of using the AIOT. A recent functional framework of AIOT was used to investigate the functional attributes via observation to confirm the availability. Then the study proceeded to interview with 10 professionals in the hospitality businesses to solicit their views about the implementation of the same AIOT facilities in other hotels based on the tabled analytical results.

Introduction

Technology has been already widely used in our life. Among various types of technologies, IoT with artificial intelligence (AIoT) technology has been quickly developed as a trend in the global world. AIoT has been popularly used in our daily life in the past decade including fundamental research, industry, transportation, business, services, and buildings. It is predicted that 350 billion devices in operation, 8.6 billion population and an average of 40 connected "things" per person, value approximating $16 trillion (close to 14% of global GDP) linked to AIoT will reach by 2030 (Loh, 2020).

To match or catch up with such a global development, many hoteliers just pick one or several of the AIoT-related applications so as to maintain the competitive advantages in the industry. Especially, because of the covid-19 and technology savvy behaviour, contactless service has become a trendy word in the hospitality service. For instances, Wynn Las Vegas as an example, in 2017, all hotel rooms were fitted with Amazon Echo (Alexa), hands-free voice-controlled speaker. At the same year, Best Western Hotels & Resorts also tested Amazon Dot devices in its hotels for guests and employees and experimenting to combine Artificial Intelligence and Big Data. In Macau, more and more hotel focus on technology so as to assist or release some

workload from human to machine. For instance, Resort Studio City of Macau focuses on provision of the entertainment employing technology -AR or VR. However, there is a paucity of information about the relatively full scale or comprehensive applications of AIoT in hotel service, especially in Asia. Besides, there is also very little information about strategic views of developing AIoT in hotel service.

Literature Review

Kevin Ashton first mentioned the term 'Internet of Things' in 1999. The Internet of Things is a kind of network that can be connected anytime and anywhere through radio frequency identification technology, wireless sensor network and 3G/4G/5G mobile communication technologies to identify, locate, track, monitor and manage smart objects (Mingjun et al., 2012). In addition, the Internet of Things has three main system-level characteristics (Miorandi et al., 2012) including (1) anything can communicate - Smart things have the ability to communicate wirelessly with each other and form a self-organizing network of interconnected objects, (2) identify anything via digital names, especially when physical interconnection cannot be established, the relationship between things can be specified in the digital domain and (3) smart things interact with the local environment through sensing and actuation functions.

The IoT provides new opportunities to connect the physical world and the digital world, and makes the interaction between tourists, hotels, tourism products and destinations more direct and active. IoT enables travelling to become much faster, more intelligent, and more embedded in the user's environment. The emergence of smartphones and their apps make such change even more dramatic (Gretzel, 2011; Wang, Park, and Fesenmaier, 2012). Smartphone technologies combined with other available technology such as wireless Internet, global navigation satellite system (GNSS), geographic information system (GIS) and global positioning system (GPS), have enabled hoteliers to meet customers' mobile hotel reservation demand by delivering time-critical, location based services (Wang and Wang, 2010).

Artificial intelligence (AIoT) is a combination of artificial intelligence (AI) technology and Internet of Things (IoT) infrastructure to achieve more efficient IoT operations and improve human-computer interaction and enhance data management and analysis. Artificial intelligence can be used to transform IoT data into useful information to improve the decision-making process, thereby laying the foundation for new technologies such as IoT data as a service. With AIoT, AI is embedded into infrastructure components, such as programs, chipsets and edge computing systems which are all interconnected with IoT networks.

Currently, many AIoT applications are geared towards retail products and usually focus on implementing cognitive computing in consumer devices. For example, as smart devices learn through human interaction and response, smart home technology has been seen as part of AIoT. In terms of data analysis, AIoT technology combines machine learning with IoT networks and systems to create data "learning machines". It can then be applied to enterprise and industrial data use cases to leverage IoT data (such as the network edge) to automate tasks in interconnected workplaces. Real-time data is the key value of all AIoT use cases and solutions. The 5G promotes the development of AIoT. In a specific case example, the AIoT solution can also be integrated with social media and human resource-related platforms to create AI decision as service capabilities for human resource professionals.

Regarding the prior studies about the adoption of innovative technologies, Roger's theory about diffusion of innovation (Roger, 1995), theory of reasoned action (Fishbein and Ajzen, 1975) and Technology Organization and Environment model (Tornatzky and Fleischer, 1990) appear to be three most relevant models for understanding hoteliers' adoption of AIoT, given their theoretical lens considering the aspects like technology, innovation and organisation.

More recently, Hameed et al. (2012) is further studying a number of related theories and conceptualized a phase based drivers for adoption. Particularly, their studies incorporate implementation phase as also a major period leading completed innovation. Nystrom et al. (2002), on the other hand, pointed out that the enhanced status of the organization in the sector or among its clients is also key driver positively influencing the adoption of innovation. Their study concluded that the greater the innovation's effect, the greater will be its capacity to assist the organization to achieve its strategic accomplishment and meet its performance targets. In view of the above research's steering direction, the study follows the implemented stage of adopting innovation, examine the degree of actual coverage by AIoT and ascertain the possible challenge in implementation.

Recently, scholars listed current studies that investigated the impact of robotics and AI on hospitality and tourism field and showed several studies on the current state of robotics and AI in hospitality and tourism (Cain et al., 2019). In addition, their review also notes that current research focus on examining and discussing implications for internal and external customer service, legal and ethical issues and theory. Then, Huang and Rust (2020) conceptualized a framework to engage customers, using AI, at different service benefits including mechanical AI for service delivery, thinking AI for personalizing service and feeling AI for making relations for leadership. Last year, research indicates that practical, ethical and legal issues about robotic support continue to lack attention whereas it needs to be addressed proactively (Fuste-Forne and Jamal, 2021).

Methods

Globally speaking, China is one of countries that has also led the development and application of AIoT technology. For this reason, the study adopted a case study approach to ascertain the degree about the full application of AIoT technologies for hotel functional service so as to offer a reference for hotelier to better understand the up-to-date development and best practice.

Sample

Flyzoo hotel is a 290-room hotel located in Hangzhou city of China. The holding company of the hotel belongs to the giant online trading conglomerate, Alibaba. The chosen hotel is Flyzoo which has been lately opened and has been regarded as the leading and pioneering hotel in automation and employment of AI technology.

Data Collection

Due to the exploratory nature, the study adopted both online search and qualitative approach in the investigation. The study consists of three stages including observation and verification of functional attributes, analysis on application of AIOT's functional attributes and seeking professionals' view on analytical results. In the first stage, two mysterious observers who have

IT or hotel experience for more than a year are hired to confirm the automation features. To ascertain the AIOT based functional service in the second stage, the study harnessed a recently developed framework containing 11 attributes to perform a systematic and online examination of the relevant attributes of studied hotel (Mercan et al., 2020). These eleven attributes include automation, hyper-personalization, queue management, asset management and energy savings, data-driven decision-making, resource and staff scheduling, supply chain management, preventive maintenance, marketing and safety. In stage 3, the study conducted interviews with 10 professionals in the hospitality businesses to solicit their views on the tabled analytical results

Data Reliability

To ensure the reliability, two guests were paid to visit the hotel and logged down their digital experience and observations in relation to the two three key products or services (room, catering and recreation) offered by studied hotel. Only common experiences are presented as findings for discussion underneath.

Findings

Common observation in the investigation indicates the adoption of following automation-related technologies.

Logged Experience - Booking, Check-in and Assistance in Rooms

Before booking, guests can see the 3D room on an official website through Augmented Reality (AR) technology to present. It can clearly see what their rooms really look like, not like some hotels post the room picture which seems very large but actually is tiny. This can narrow the guest expectation gap, then enhance their satisfaction.

After the guest places an order online, they can directly enter the hotel, and check-in by self at the kiosk with a simple step. For Chinese guests, it would be more convenient to check-in via their mobile apps, Alipay. This step is to scan and record guests' facial features and confirm the guest information. Then, they can go straight to the room.

Guests can access their room through Facial Recognition Technology (FRT), instead of a traditional room card, no matter in the elevator or room door. It means that everything is as easy as smiling for the camera in the hotel.

AIOT technology applies in hotel rooms. Each room is equipped with one Tmall Genie voice assistant with artificial intelligence which can perform not only the music playing function. It can base on Machine learning technology and its cloud computing to improve and upgrade by itself. In Flyzoo hotel, it combines with IOT technology to control rooms' equipment, it can adjust the temperature, light, curtains and TV. In addition, guests can input a passcode on delivery robots to receive what their requests from Tmall Genie which connects with hotel's back office which will activate the robot, as a 24/7 personal butler, would deliver required amenities to room. The robot called, Yuanbao, was used instead of manpower. The robot can connect with the elevator system and go to different floors

Logged Experience - Food & Beverage Services

Delivery robots are also used at the hotel's restaurants for delivery of ordered food and beverage to guest at table. In addition, the hotel installed an imported robotic arm that makes drinks and serves as bartender to prepare drinks.

Logged Experience -Digital Gym Room

Gym Room in Flyzoo operates 24 hours a day. Other than traditional fitness equipment, holographic projection technology in the gym room, where has a large holographic projection screen, allowing guests to follow the virtual teacher's action, providing an immersive experience aerobics class.

Analysis on Functional Attributes and Application

In accordance with the eleven identified functional attributes of Mercan's framework, the study finds that the examined hotel invested and applied AIoT technology in 6 functional areas – automation, hyper-personalization, que management, data-driven decision making and marketing using personal information. In other words, the full usage rate of AIoT has been confined to 55% of the specified dimensions in the framework.

Table 1: The Counted Functional Attributes and Applied Applications in Studied Hotel

Main attributes in the framework	Sub- attributes in the framework	Identified Application (i.e. sub attributes) in studied hotel	Counted application in studied hotel
1.Automation	Check in, temperature control, smart locks, others enhance service experiences	Check-in via kiosks and mobile phone In-room service controller FR technology for lock in for six areas Robotic service in bar and delivery to room	1 1 1 1
2.Hyper-personalization	Learning, interaction, empowering, feedback, delight, self-designed product	In-room voice controller, press robot's keyboard for rating service performance	1 1
3.Queue management	Embarking to cruise ship, streamlining process of choice. Queue system improve the service	Self-check-in kiosk Credited member exempted from queueing up for payment by using settlement via APP or posting to guest account via facial recognition	3 3
4. Data- driven decision-making		Cloud based big data platform	1
5. Resource and staff scheduling	Employee/fast service	Personnel management system	1
6. Marketing	Using personal information for market	Cloud based CRM system	2

The functional attributes being developed are basically described by the observers on the above section. In summary, guests can book and check-in through an application, use elevators and access their rooms with facial recognition and the gym offers fun digital experiences and interactive workouts. Customers can control their smart rooms, get information and access the room service via Tmail Genie smart assistant from the comfort of their bed, while robot butlers will deliver their orders to the door. The automation enables the employees to convey exceptional customer service while digital systems maintain routine operations.

However, it is interesting to note that existing function of hyper personalization has been limited to feedback by pressing robot's keyboard for rating service performance.

For the queue management, it is observed that self-check-in service is available and runs smoothly. Moreover, the study also finds that credited members are exempted from queueing for any payment by using either APP like Ali-pay or posting to guest account via FRT.

The latter facial recognition technology (FRT) has been found as lock in or accessing tools in six areas. Compared with other earlier studies in the hospitality field, the study noted that FRT has been matured and applied successfully and vastly in this latest case.

Views on the Unidentified Functional Attributes or Unmentioned Application

As it can be seen from the table, the study notes that there are 5 applications of AIoT have not yet been made or partly made in the examined hotel, namely asset management, preventive maintenance, staff and scheduling, supply chain management. Underneath are the views of hotel professionals for these unmentioned applications.

Table 2: The Counted Functional Attributes and Unapplied Applications in Studied Hotel

Main attributes in the framework	Sub- attributes in the framework	Identified Application (i.e. sub attributes) in studied hotel	Counted application in studied hotel
7.Location-aware services	GPS, infrared tags. Interact with customers location information	Not mentioned	0
8.Asset management and energy savings	Energy consumption, real-time monitoring, profit, calculation	Not mentioned	0
9. Supply chain management	Benefit of lean manufacturing at performance frontiers	Not mentioned	0
10 Preventive maintenance	Sensors for watching symptoms	Not mentioned	0
11. Safety	Track valuable items, children	Not mentioned	0
	Detect mask wearing	Not mentioned	0
	Facial recognition	Facial shape recognition	1
		Facial recognition hardware and software	3

One interviewee reflects that the relatively smaller number of rooms in the properties does not economically justify for the asset management application or retrofit, especially because there is no such kind of hotel that heavily applied AIoT technology and thus it is difficult to find a yardstick for comparison. with the average figures of each indicator generated by the building management system. In addition, one informant viewed that, following the trend about broader application of sensors and software technology, hoteliers may rather initiate the intention to purchase this sort of AIoT linked sensors directly with the manufacturer or agent of respective equipment, say the chiller system. It is especially because many manufacturers of equipment or facilities have already designed and developed compatible hardware and software that allows automation for its existing and prospective facilities. Some hotel owners prefer to pay a higher cost on the system.

Regarding the main attribute – safety as defined in the adopted framework, the informants expressed that activity zones and adjacent areas of hotels in the territory are safe. Importantly, most guest's portable phones have already installed the GPS trailing function and there is no worry of lost way. Whereas informants do regard that the strip with GPS could be explored on a service item for children. However, one respondent raised that the smoke detector using the sensor technology and the foreign language translator using the AI technology may add the sense of safety to international guests or visitors.

For the use of supply chain management, one interviewee mentioned that the studied hotel's holding corporation has already owned one giant global and one leading domestic online mall. The hotel's procurement office should have a close link with these two malls on purchasing hotel consumables and small equipment. The development of AI on this function will have an overlapping with existing human capability and a waste of resource. On the other hand, the same interviewee added that, for hotel less than 400 room, manual arrangement of staffing using general office software is far more than enough.

In terms of queue management, informant regarded the application of wearable device as a way to quicken the wait time is not applicable in the studied hotel. It is chiefly because the room check-in speed has been greatly quickened via the hotel' tailored check-in APP which may even assign room and lock opening codes to guests. For the deluxe restaurant service, advance booking practice is usually adopted by hoteliers.   Thus, there is no que formation in dining house. However, there are some hotels or resorts with popular restaurants that has queuing phenomenon; most hoteliers or outlets have already adopted the booking or que management system that dispatch call signals to booker's mobile phone about the availability of seat in the coming 15 minutes. The estimation is based on AI technology.

Hyper-personalization is not applicable for the studied deluxe hotel or the hotel that targets market segment at lower end market. Whereas respondents hold the view that data mining via the historical guest data may help hotel operators to offer more personalized service like preference for pillow, room types and birthday cake etc. to loyalty guests. Then, such service depends on manpower availability of revenue management team. However, many hotels follow heavily on profit maximizing behavior; manpower for revenue management or service analyst has thus been reduced.

Conclusions

AIoT is important to hospitality and will be one of the future trends. Currently, more and more hotel focus on developing technology and apply in daily routine or guest rooms in order to provide a new experience to customer. This can help to differentiate their hotel with others and become one of the competitive advantages. While the research finds that the studied hotel has not yet fully or comprehensively developed and applied AIoT, its application and implementation of facial recognition technology (FRT) is viewed as successful. Especially the vast implementation of FRT in this case implies that FRT is mature and can be applied and adopted in the hotel sector.   To achieve this, the specialized training and in-depth understanding of complex mechanism and sophisticated technologies of FRT via education and research should be promoted in near future in the hospitality sector. In addition, recent research suggests to pay closer attention to the potential of "cocreation" for addressing innovations in enhanced service experiences in the hospitality and tourism (Fuste-Forne and Jamal, 2021. Also, new research paradigms may be extended to explore the posthumanist and transhumanist transitions.

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