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Application of internet of things (IOT) in the hotel industry in the Nilgiri district

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Abstract
This study explores the adoption of the Internet of Things (IoT) in the hotel industry. It focuses on the implementation of the Internet of Things including sensors, data storage, data analytics and visualization. The study also examines the benefits like enhancing visitor satisfaction and experiences, maintenance and repairs, revenue management, convenience and comfort. However, the study addresses the challenges of implementing the Internet of Things like High Initial Costs, timely upgrades and poor network connection. The primary data was collected through a structured questionnaire from 100 hotels using a convenient sampling method. Tools used for this study are Percentage analysis, Descriptive Statistics, Independent t-test and One Way ANOVA. The findings of the study will assist the hotel industry in improving operational efficiency, customer service and long-term growth. It also helps the hotel owner to know the benefits and challenges in the implementation of the Internet of Things in hotels.

Keywords: Internet of things, adoption, benefit, challenges

Introduction
The concept of IoT appeared in 1999 [1]. The Internet of Things (IoT) is the network of physical objects embedded with electronics, software, sensors, and networks that turn into intelligent objects and allow it to collect and exchange data [2]. It plays a major role in establishing a system for communicating among different devices, opening communication channels not only among people but also between institutions and different networks in addition to collecting data through various devices and storing them. It also plays a major role in improving operational efficiency due to its superior ability to collect huge data. Electronic development led to the creation of microelectronic systems able to rapidly sense and communicate information as well as process wireless data. The wireless sensor network comprising small nodes functions as an effective system for temperature monitoring and traffic surveillance and retail evaluation. Cloud computing platform plays multiple roles in the Internet of things: it acts as a receiver of information from a sensor network, a processing system that analyzes, interprets the information and visualizes the information [3]. Nowadays, many hospitality businesses for enhancing customer satisfaction, staff productivity and environmental sustainability have already successfully implemented IoT applications [4].

Review of Literature
Suat Mercan *et al*., (2020) [5] have undertaken a study on "Improving the service industry with hyper-connectivity: IoT in hospitality" and explore how IOT technologies enhance the provision of services to consumers and productivity within the hospitality industry. It explores smart rooms, connected devices, and automatization in delivering customization, energy efficiency and smart resource sharing among guests. Real-time monitoring and predictive analytical techniques also help to minimize costs and optimize the work of the staff in the context of IOT. There exist obstacles however such as privacy, high costs involved during implementation, and security challenges are recognized. The study explores that IoT has transformative potential, yet it needs a more profound consideration of these challenges. Finally, it focuses on future trends depicting customer-oriented IoT-based hospitality services. Ljubica Pilepic Stifanich *et al*., (2019) [6] have undergone a study on the role of IoT in the Tourism and Hospitality industry and are explained in detail along with its pros and cons. Sensors, smart rooms, and automation also play an important role in improving the guests' quality and experience by offering IoT-based services.

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IoT also adds up operational efficiency advantages regarding resource use and energy consumption. However, challenges such as high implementation costs, cybersecurity risks, and lack of industry-wide standards hinder and reduce its adoption. The study explores that under these challenges, IoT has the potential to revolutionize the sector provided the financial, technological and regulatory predicaments are solved. In the end, through IoT, services could be made smart or efficient and more importantly sustainable.

Tamara Gaji C *et al*., (2024) [7] have examined "Innovative Approaches in Hotel Management: Integrating Artificial Intelligence (AI) and the Internet of Things (IoT) to Enhance Operational Efficiency and Sustainability" to identify how Artificial Intelligence (AI) and the Internet of Things (IoT) helps in improving Operational Efficiency and Sustainability. A qualitative method was used for surveys of hotel managers in the Republic of Serbia. Structural Equation Modeling (SEM) model is used to identify the improving Operational Efficiency and Sustainability. The result shows that integration of technology like Artificial Intelligence (AI) and the Internet of Things (IoT) not only helps in improving Operational Efficiency but also to achieve Sustainability goals like environment prevention and carbon footprint. The study provides both theoretical and practical recommendations for hotel managers to further improve sustainability efforts.

Statement of the problem
The implementation of the Internet of Things in the hotel industry offers more benefits but also faces some issues in adoption. Small and medium-sized hotels face challenges like high initial Costs, timely upgrades and poor network connection and technical challenges. Making the Internet of Things work well with old systems and keeping data safe are more important but it is a complex task. Additionally, insufficient staff training and cybersecurity threats disrupt the effective use of these technologies. This research explores the benefits and challenges of the Internet of Things implementation to bridge the gap between new ideas and practices.

Scope of the study
This study explores how IoT technologies are used in the hotel industry, focusing on smart features like sensor room controls, predictive maintenance and data storage systems. It examines how the Internet of Things technologies enhance visitor satisfaction and experiences, boost efficiency and support sustainability while addressing challenges like data privacy and cybersecurity. By examining technology, costs and organizational factors, the study aims to give useful advice to hotel managers and decision-makers. The study explains industry trends to give practical advice, focusing only on IoT in hotels for a clear and simple analysis.

Objectives of the study
- To analyze the implementation of digitization in the Hotel Industry using IoT.
- To study the Benefits and Challenges in adoption of IoT in the Hotel Industry.

Research Methodology
Area of the study
The study is conducted in Nilgiri District.

Source of data
The study is predominantly based on Primary data. It has been collected through a structured questionnaire from hotel managers. Secondary data required for the study was collected from journals and magazines.

Sample Size
The sample size is 100 hotels.

Statistical tools
- Percentage analysis
- Descriptive Statistics
- Independent t-test and
- One Way ANOVA

Analysis and Interpretation

Table 1: Profile of the hotels

Profile of the hotels	Particulars	No of Respondents	Percent
Gender	Male	86	86.0
	Female	14	14.0
Position	General managers	35	35.0
	Assistant managers	40	40.0
	Supervisors	17	17.0
	Executives	8	8.0
Experience	0-5years	45	45.0
	6-10 years	49	49.0
	11-15 years	5	5.0
	More than 15 years	1	1.0
Type of hotel	Three stars	56	56.0
	Four stars	26	26.0
	Five stars	18	26.0
Guest rooms	30-50	65	65.0
	51-70	20	20.0
	71-90	2	2.0
	Above 91	13	13.0
Types of Rooms	Single	1	1.0
	Double	32	32.0
	Deluxe	58	58.0
	Suite	9	9.0
Types of visitors	Budget travelers	18	18.0
	Families	67	67.0
	Couples	5	5.0
	Business travelers	10	10.0
Price of the room	Rs.3000 to Rs.4000	45	45.0
	Rs.4001 to Rs.5000	39	39.0
	Rs.5001 to Rs.6000	14	14.0
	Above Rs.6001	2	2.0
Room booked per day	1-5 rooms	45	45.0
	6-10 rooms	30	30.0
	11-15 rooms	5	5.0
	More than 16 rooms	20	20.0

(**Source:** Primary data)

The table 7.1 shows that 86.0 percent of the hotel managers are male, 40.0 percent of the respondents are assistant managers, 49 percent of the respondents have 6-10 years of experience, 56.0 percent of the hotels are three Star Category, 65.0 percent of the hotels have 30-50 guest rooms, 58.0 percent of the hotels booked deluxe rooms. 67.0 percent of the hotels have family visitors, 45.0 percent of the hotels booked Rs.3000 to Rs.4000 price range of rooms per day and 45 percent of the hotels booked 1- 5 rooms per day.

Descriptive Statistics

Descriptive Statistics has been used to find the mean score for IoT implementation in the hotel industry. The level of IoT adoption was assessed by summing the ratings given by respondents for eight statements on a five-point scale. The mean ratings have been assigned as follows :5 for 'Strongly Agree', 4 for 'Agree',3 for 'Neutral'.2 for 'Disagree' and 1 for 'Strongly Disagree'.

Table 2: Level of implementation of digitization in the hotel industry using IoT

Factor	Mean	Std. Deviation
Level 0: Sensor		
Sensor controls the heaters and coolers that maintain the temperature of the room automatically	4.07	.844
Sensors control lights based on the customer's presence in a room or not	4.01	.798
Sensors help to prevent damage and repairs and water leaks	4.04	.840
Smart smoke detectors send an alarm to both the staff and customers in case of a fire	3.99	.859
Level 1: Data storage & data analytics		
Data storage is used to Store customer profiles, records and feedback	4.06	.851
Data analytics are used for Sustainability, Process real-time data and improve overall workflow	4.05	.833
Level 2: Data Visualization & Interpretation		
Data visualization helps in monitoring and making quick decision	4.03	.858
Data Interpretation helps in analyzing the cyclical and seasonal patterns in booking	4.10	.810

Source: Primary data

The table 7.2 reveals the result of the descriptive statistics regarding the level of implementation of digitization in the Hotel Industry using IoT. The highest mean score (4.10) has been found for 'Data Interpretation helps in analyzing the cyclical and seasonal pattern in booking' with the standard deviation (.810) and the lowest mean score (3.99) has been found for 'Smart smoke detectors send an alarm to both the staff and customer in case of a fire' with the standard deviation (.859).

Profile of the hotels Vs Level of implementation of digitization in the Hotel Industry using IoT

Independent t-test has been applied to test the differences based on gender and the level of implementation of digitization in the hotel industry using IoT. ANOVA has been applied to find the significant difference between the profile of the hotels namely age, position, experience, type of hotel, guest rooms, types of rooms, types of visitors, price of the room, room booked per day and the level of implementation of digitization in the hotel industry using IoT.

Hypothesis

H_0-There is no significant difference between the profile of the hotels and the level of implementation of digitization in the hotel industry using IoT.

H_1-There is a significant difference between the profile of the hotels and the level of implementation of digitization in the hotel industry using IoT.

Table 3: Profile of the hotels Vs Level of implementation of digitization in the hotel industry using IoT

Profile of the hotels		N	Mean	Std Deviation	F Value	T Value	P Value	S/NS
Gender	Male	86	3.9520	.77416	-	-4.219	.000	**
	Female	14	4.6071	.48994				
Position	General Manager	35	4.0571	.84199	4.229	-	.007	**
	Assistant manager	40	3.8000	.75575				
	Supervisor	17	4.2721	.52521				
	Executive	8	4.7188	.46651				
Experience	0-5years	45	3.9583	.72202	.892	-	.448	NS
	6-10 years	49	4.0714	.83151				
	11-15 years	5	4.3750	.61237				
	More than 15 years	1	4.8750	.00000				
Type of hotel	Three stars	56	3.5759	.56038	46.052	-	.000	**
	Four stars	26	4.5144	.63080				
	Five stars	18	4.8194	.43136				
Guest rooms	30-50	65	3.7077	.69008	18.070	-	.000	**
	51-70	20	4.6062	.59780				
	71-90	2	4.4375	.61872				
	Above 91	13	4.7981	.13049				
Types of Rooms	Single	1	3.1250	.00000	3.157	-	.028	*
	Double	32	4.0117	.74822				
	Deluxe	58	3.9720	.77234				
	Suite	9	4.7222	.77234				
Types of visitors	Budget travelers	18	3.6250	.75245	7.455	-	.000	**
	Families	67	3.9944	.74157				
	Couples	5	4.7000	.36012				
	Business travelers	10	4.8000	.42164				
Price of the room	Rs.3000 to Rs.4000	45	3.9889	.71501	3.151	-	.028	*
	Rs.4001 to Rs.5000	39	3.9038	.79651				

	Rs.5001 to Rs.6000	14	4.4732	.75029			
	Above Rs.6001	2	5.0000	.00000			
Room booked per day	1-5 rooms	45	3.5528	.53598	20.273	-	.000	**
	6-10 rooms	30	4.2417	.84648				
	11-15 rooms	5	4.9750	.05590				
	More than 16 rooms	20	4.6188	.38576				

(**Source:** Computed) NS- Not Significant *- Significant at 5% level
**- Significant at 1% level

The independent t-test for gender confirms that gender has a significant impact on the level of implementation of digitization in the hotel industry using IoT. Hence, the null hypothesis is rejected for this factor.

ANOVA result shows that the position, type of hotel, guest room, types of rooms, types of visitors, price of the room and room booked per day have a significant difference with the level of implementation of digitization in the hotel industry using IoT. Hence, the null hypothesis has been rejected with respect to position, type of hotel, guest room, types of rooms, types of visitors, price of the room and room booked per day. Experience has no significant difference with the level of implementation of digitization in the hotel industry using IoT. Hence, the null hypothesis has been accepted with respect to experience.

Descriptive Statistics

Descriptive Statistics has been used to find the mean score for benefit of IoT adoption in the hotel industry. The benefit of IoT adoption was assessed by summing the ratings given by respondents for eleven statements on a five-point scale. The mean ratings have been assigned as follows :5 for 'Strongly Agree', 4 for 'Agree',3 for 'Neutral'.2 for 'Disagree' and 1 for 'Strongly Disagree'. High scores indicate that Hotels use technology like personalized recommendations, smart room features to make guests feel valued and create memorable stays.

Table 4: Benefit of IoT adoption in the hotel industry

Factor	Mean	Std. Deviation
Enhancing visitor satisfaction and experiences		
Hotels use technology like personalized recommendations, smart room features to make guests feel valued and create memorable stays	4.23	.694
Mobile Apps and facial recognition make check-ins faster and more convenient	4.16	.735
Maintenance and Repairs		
HVAC (Heating, Ventilation, and Air Conditioning) with IoT enables real-time control of temperature and air quality. This helps to save energy and keeps the environment comfortable for customers	4.10	.810
Smart elevators help customers decrease the waiting time which enhances efficiency and convenience for the customer	4.09	.842
IoT sensors constantly check the health of equipment based on the data received	4.04	.852
Revenue Management		
Fast information flow allows hotel rates to be changed in relation with the occupancy rate, competitor prices and seasonal rate	4.08	.849
Big data analyzes past services and products to forecast seasonal demand, optimize resources, and set accurate hotel pricing	4.08	.813
Hotels utilize the customer data to ensure that they post advertisements that meet the taste and preference of their customers.	4.13	.800
Convenience and Comfort		
Smart devices in rooms help the guests to control the room and get services.	4.17	.792
Smart parking systems and digital vehicle access ensures guests are offered convenient and secure ways to park as well as to access the hotel.	4.14	.829
Smart TVs provide hotel service menus and information regarding guest preferences to guarantee diverse content according to Customer choice.	4.12	.868

Source: Primary data

The table 7.3 reveals the result of the descriptive statistics regarding the benefit of IoT Adoption done in the Hotel Industry. The highest mean score (4.23) has been found for 'Hotels use technology like personalized recommendations, smart room features to make guests feel valued and create memorable stays' with the standard deviation (.694) and the lowest mean score (4.04) has been found for 'IoT sensors constantly check the health of equipment based on the data received' with the standard deviation (.852).

Profile of the hotels Vs Benefit of IoT adoption in the hotel industry

Independent t-test has been applied to test the differences based on gender and the benefit of IoT adoption in the hotel industry. ANOVA has been applied to find the significant difference between the profile of the hotel, namely age, position, experience, type of hotel, guest rooms, types of rooms, types of visitors, price of the room, room booked per day and the benefit of IoT adoption in the hotel industry.

Hypothesis

H_0-There is no significant difference between the profile of the hotels and the benefit of IoT adoption in the hotel industry

H_1-There is a significant difference between the profile of the hotels and the benefit of IoT adoption in the hotel industry

Table 5: Profile of the hotel Vs Benefit of IoT adoption in the hotel industry

Profile of the hotel		N	Mean	Std Deviation	F Value	T Value	P Value	S/NS
Gender	Male	86	4.0391	.70646	-	-2.909	.004	**
	Female	14	4.6299	.69369				
Position	General Manager	35	4.1481	.75098	2.651	-	.053	NS
	Assistant manager	40	3.9250	.71163				
	Supervisor	17	4.2995	.52888				
	Executive	8	4.6136	.88106				
Experience	0-5years	45	4.0040	.73676	.935	-	.427	NS
	6-10 years	49	4.1948	.73925				
	11-15 years	5	4.3455	.56187				
	More than 15 years	1	4.7273	.00000				
Type of hotel	Three stars	56	3.6802	.54297	45.025	-	.000	**
	Four stars	26	4.5839	.56403				
	Five stars	18	4.8283	.43753				
Guest rooms	30-50	65	3.8070	.65546	18.122	-	.000	**
	51-70	20	4.6318	.55374				
	71-90	2	4.3636	.51426				
	Above 91	13	4.8741	.12048				
Types of Rooms	Single	1	3.9091	.00000	2.633	-	.054	NS
	Double	32	4.0625	.73145				
	Deluxe	58	4.0596	.73037				
	Suite	9	4.7576	.48319				
Types of visitors	Budget travelers	18	3.6616	.74432	7.942	-	.000	**
	Families	67	4.0963	.68413				
	Couples	5	4.7636	.33771				
	Business travelers	10	4.8000	.42164				
Price of the room	Rs.3000 to Rs.4000	45	4.0141	.71764	2.930	-	.038	*
	Rs.4001 to Rs.5000	39	4.0583	.71627				
	Rs.5001 to Rs.6000	14	4.5195	.69548				
	Above Rs.6001	2	5.0000	.00000				
Room booked per day	1-5 rooms	45	3.6465	.53720	20.578	-	.000	**
	6-10 rooms	30	4.3424	.74992				
	11-15 rooms	5	4.9455	.12197				
	More than 16 rooms	20	4.6545	.40506				

(**Source:** Computed) NS- Not Significant *- Significant at 5% level **- Significant at 1% level

The independent t-test for gender confirms that gender has a significant impact on the benefit of IoT adoption in the hotel industry. Hence, the null hypothesis is rejected for this factor.

ANOVA result shows that the type of hotel, guest rooms, types of visitors, price of the room and rooms booked per day have a significant difference with the benefit of IoT adoption in the hotel industry. Hence, the null hypothesis has been rejected with respect to type of hotel, guest rooms, types of visitors, price of the room and rooms booked per day. Position, experience and type of room have no significant difference with the benefit of IoT adoption in the hotel industry. Hence, the null hypothesis has been accepted for the factors namely, position, experience and type of room.

Descriptive Statistics

Descriptive Statistics has been used to find the mean score for challenges of IoT adoption in the hotel industry. The challenges of IoT adoption were assessed by summing the ratings given by respondents for nine statements on a five-point scale. The mean ratings have been assigned as follows :5 for 'Strongly Agree', 4 for 'Agree',3 for 'Neutral'.2 for 'Disagree' and 1 for 'Strongly Disagree'. High scores indicate that Conductive and timely upgrading, servicing and checking of the IoT Device

Table 6: Challenges of IoT adoption in the hotel industry

Factor	Mean	Std. Deviation
High Initial Costs that are often incurred by the hotel to update the new technologies and other infrastructures.	4.06	.814
Seamless operations like managing feedback and staff communication are Complex integration in implementation.	4.08	.813
Right technical expertise is essential for managing and maintaining IOT device	4.13	.812
Disabilities such as having a poor connection to Wi-Fi or the network connection in general.	4.11	.863
Accumulation of big data through IOT hotels has to maintain the privacy of guests and avoid exposures to data loss.	4.15	.809
Conductive and timely upgrading, servicing and checking of the IOT Device	4.16	.788
Prolonged utilization of IoT devices will lead to higher energy demands and reduce operating constructed costs.	4.15	.796
Extending the IoT systems to construct new rooms or new locations may prove difficult and expensive.	4.08	.861
Various IoT devices and platforms are incompatible and this causes some systems to function inefficiently.	4.09	.830

(**Source:** Primary data)

The table 7.4 reveals the result of the descriptive statistics regarding the challenges of IoT adoption done in the hotel industry. The highest mean score (4.16) has been found for 'Conductive and timely upgrading, servicing and checking

of the IoT Device' with the standard deviation (.788) and the lowest mean score (4.06) has been found for 'High Initial Costs that are often incurred by the hotel to update the new technologies and other infrastructures' with the standard deviation (.814).

Profile of the hotels Vs Challenges of IoT adoption in the hotel industry

Independent t-test has been applied to test the differences based on gender and the challenges of IoT adoption in the hotel industry. ANOVA has been applied to find the significant difference between the profile of the hotel namely age, position, experience, type of hotel, guest rooms, types of Rooms, types of visitors, price of the room, room booked per day and the challenges of IoT adoption in the hotel industry.

Hypothesis

H_0-There is no significant difference between the profile of the hotels and the challenges of IoT Adoption in the hotel Industry

H_1-There is a significant difference between the profile of the hotels and the challenges of IoT Adoption in the hotel Industry

Table 7: Profile of the hotels Vs Challenges of IoT Adoption in the Hotel Industry

Profile of the hotel		N	Mean	Std Deviation	F Value	T Value	P Value	S/ NS
Gender	Male	86	4.0401	.69230	-	-2.499	.014	*
	Female	14	4.5556	.85290				
Position	General Manager	35	4.0921	.77144	2.459	-	.067	NS
	Assistant manager	40	3.9472	.66998				
	Supervisor	17	4.3007	.53686				
	Executive	8	4.6250	1.01651				
Experience	0-5years	45	4.0173	.73166	.599	-	.617	NS
	6-10 years	49	4.1859	.73751				
	11-15 years	5	4.1333	.82925				
	More than 15 years	1	4.6667	.00000				
Type of hotel	Three stars	56	3.6567	.52128	49.467	-	.000	**
	Four stars	26	4.5983	.57010				
	Five stars	18	4.8272	.44481				
Guest rooms	30-50	65	3.7863	.64499	19.613	-	.000	**
	51-70	20	4.6444	.55450				
	71-90	2	4.4444	.62854				
	Above 91	13	4.8718	.14234				
Types of Rooms	Single	1	3.3333	.00000	3.034	-	.033	*
	Double	32	4.0868	.71271				
	Deluxe	58	4.0402	.73841				
	Suite	9	4.7531	.49309				
Types of visitors	Budget travelers	18	3.7469	.71584	6.825	-	.000	**
	Families	67	4.0597	.70680				
	Couples	5	4.7556	.42601				
	Business travelers	10	4.8000	.42164				
Price of the room	Rs.3000 to Rs.4000	45	4.0469	.69892	3.076	-	.031	*
	Rs.4001 to Rs.5000	39	3.9943	.74838				
	Rs.5001 to Rs.6000	14	4.5238	.67576				
	Above Rs.6001	2	5.0000	.00000				
Room booked per day	1-5 rooms	45	3.6272	.53400	22.041	-	.000	**
	6-10 rooms	30	4.3296	.74019				
	11-15 rooms	5	4.9778	.04969				
	More than 16 rooms	20	4.6611	.40861				

(**Source:** Computed) NS- Not Significant *- Significant at 5% level **- Significant at 1% level

The independent t-test for gender confirms that gender has a significant impact on the challenges of IoT adoption in the hotel industry. Hence, the null hypothesis is rejected for this factor.

ANOVA result shows that the type of hotel, guest rooms, types of rooms, types of visitors, price of the room and rooms booked per day have a significant difference with the challenges of IoT adoption in the hotel industry. Hence, the null hypothesis has been rejected with respect to type of hotel, guest rooms, types of rooms, types of visitors, price of the room and rooms booked per day. Position and experience have no significant difference with the respect of challenges of IoT adoption in the hotel industry. Hence, the null hypothesis has been accepted with the respect of position and experience.

Findings

Profile of the hotels
- 86.0 percent of the respondents are male.
- 40.0 percent of the respondents are Assistant managers.
- 49.0 percent of the respondents have 6-10 years of Experience.
- 56.0 percent of the hotels are Three Star Category.
- 65.0 percent of the hotels have 30-50 Guest rooms.
- 58.0 percent of the hotel booked Deluxe room.
- 67.0 percent of the hotels have family visitors.
- 45.0 percent of the hotels booked Rs.3000 to Rs.4000 price range of the rooms per day.
- 45.0 percent of the hotels booked 1-5 rooms per day.

Level of implementation of digitization in the hotel industry

- The highest mean score (4.10) has been found for 'Data Interpretation helps in analyzing the cyclical and seasonal pattern in booking' with the standard deviation (.810) and the lowest mean score (3.99) has been found for 'Smart smoke detectors send an alarm to both the staff and customer in case of a fire' with the standard deviation (.859).
- Gender has a significant impact on the level of implementation of digitization in the hotel industry using IoT.
- The factors namely, position, type of hotel, guest room, types of rooms, types of visitors, price of the room and room booked per day have a significant difference with the level of implementation of digitization in the hotel industry using IoT. Experience has no significant difference with the level of implementation of digitization in the hotel industry using IoT.

Benefit of IoT adoption in hotel industry

- The highest mean score (4.23) has been found for the statement namely, 'Hotels use technology like personalized recommendations, smart room features to make guests feel valued and create memorable stays' with the standard deviation (.694) and the lowest mean score (4.04) has been found for 'IoT sensors constantly check the health of equipment based on the data received' with the standard deviation (.852).
- Gender has a significant impact on the benefit of IoT adoption in the hotel industry.
- The factors namely, type of hotel, guest rooms, types of visitors, price of the room and rooms booked per day have a significant difference with the benefit of IoT adoption in the hotel industry. Position, experience and type of room, have no significant difference with the benefit of adoption in the hotel industry.

Challenges of IoT adoption in hotel industry

- The highest mean score (4.16) has been found for 'Conductive and timely upgrading, servicing and checking of the IoT device' with the standard deviation (.788) and the lowest mean score (4.06) has been found for 'High initial costs that are often incurred by the hotel to update the new technologies and other infrastructures' with the standard deviation (.814).
- Gender has a significant impact on the challenges of IoT adoption in the hotel industry.
- The factors namely, type of hotel, guest rooms, types of rooms, types of visitors, price of the room and rooms booked per day have a significant difference with the challenges of IoT adoption in the hotel industry. Position and experience have no significant difference with the challenges of IoT adoption in the hotel industry.

Suggestions

- Hotels should concentrate on enriching the fire safety measures by adopting IoT detectors to send quick information to employees and customers in case of emergency.
- Expanding the Implementation of sensor-based lighting in the hotels can improve cost saving while providing personalized room setting for the customer.
- Investing in advanced data visualization tools can help hotel managers to make decisions quickly regarding operation efficiency and customer services.
- Improving the use of IoT sensors for monitoring health equipment can allow hotels to find the issue early and to reduce maintenance cost.
- Adopting advanced smart elevators in the hotels can reduce the waiting time of the customer and enhances the overall experience of the guest.
- Hotels can optimize real-time revenue management strategies to change rates in relation with the occupancy rate, competitor prices and seasonal rate.
- Enhancing IoT adoption with standardized systems in hotels can improve feedback management and staff communication.

Conclusion

This study explores the application of Internet of Things technology in the hotel industry with the opportunity to introduce more operational efficiency, improve the quality of customer solutions and advance sustainability. However, for successful implementation challenges like high initial costs, timely upgrade, data privacy issues and technical difficulties are being addressed. To overcome these obstacles, hotels should ensure they provide training for their employees and take adequate security measures to overcome the challenges in future. As the industry adopts digital transformation, the Internet of Things plays a main role in promoting innovation and long-term development. The implications of the research in this paper offer clear direction to hotel owners regarding the application of IoT, thereby fostering a more intelligent and connected, as well as environmentally responsible future for the hospitality industry.

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