

# **Tech-Enabled Cleanliness: A Study on Customer Satisfaction towards Tech based Cleaning in Multiplex Housekeeping**

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## **Abstract**

The use of technology in operations, especially in the area of housekeeping, has significantly changed the movie theatre industry. Because they serve a lot of people every day, multiplexes have strict standards for hygiene and cleanliness. The impact of technology developments on improving housekeeping procedures in multiplexes is examined in this study. The study examines customer perceptions, operational effectiveness, and the efficacy of digital solutions like IoT-enabled cleaning, robotic floor scrubbers, mobile housekeeping apps, and AI-driven scheduling using a mixed-method approach. The results show that brand loyalty, operational consistency, and customer satisfaction are all positively correlated with tech-enabled housekeeping.

**Keywords** -Technology, multiplex, Housekeeping, Robot, IOT, AI

## **1. Introduction**

The emergence of automation and smart technology in recent years has had a big impact on service industries like entertainment and hospitality. Cleaning is now seen as an essential part of both operational branding and customer pleasure in multiplex theatres, rather than just a supporting role. Kumar (2020) Cleanliness has become a crucial hygiene factor that directly affects foot traffic and ratings due to rising customer expectations following COVID-19. With an emphasis on customer happiness and operational enhancements, this study examines how technological advancements are changing housekeeping procedures in multiplexes.

Customer expectations and operational excellence have been redefined by the emergence of technology in the service sector. Cleaning and hygiene are no longer merely auxiliary tasks in the fiercely competitive entertainment industry, especially at multiplex theatres, where they are now important factors in determining patron happiness and repeat business. Multiplexes confront a lot of housekeeping issues because of their high foot traffic, short show turnaround times, and requirement to maintain hygienic standards.

When it comes to solving these problems, technological advancements have proven to be revolutionary. Kumawat et.al., (2025) Modern tools are transforming conventional housekeeping procedures, from robotic cleaning equipment and sensor-based lavatory monitoring to mobile applications that allow for real-time work management and audits. Along with streamlining operations, these innovations also boost employee productivity, transparency, and consumer trust.

Song et al., (2022) states as hygiene and visible sanitation became essential for customer assurance during the COVID-19 pandemic, the adoption of tech-enabled cleaning practices was further accelerated. Not only is cleanliness required in this new setting, but it is also demanded and frequently tracked digitally by customers using visual indicators and feedback systems.

This study looks into how technological tools might improve multiplex housekeeping efficiency. The goal of the study is to comprehend how these developments affect customer happiness and perceptions as well as operational efficiency. For multiplex operators looking to include smart housekeeping technologies and gain a competitive edge through superior hygiene, the findings are intended to offer insightful information.

## **2. Literature Review**

### **2.1 Importance of Housekeeping in Cinemas**

Housekeeping plays a vital role in maintaining customer experience and brand value in cinemas. A study by Kumar (2020) emphasized that hygiene in public entertainment venues directly influences customer loyalty and satisfaction.

Aguilar-Escobar et al.,(2021) highlighted that considering how many hours it takes and how it affects guest pleasure, housekeeping is a crucial hotel procedure. Few prior scientific research, however, have examined this subject or the factors that influence how long it takes to clean a room.

Zemke Dina Marie V et al.,(2015) stated in this study is that there might be a marketable sector of visitors who are prepared to pay more for guestrooms that are cleaned with methods of increased disinfection that go beyond standard room cleaning practices. Hotel guests care about the cleanliness of their rooms. At a premium, certain hotel companies now provide allergy-free accommodations. But at the moment, there are no hotel brands catering to the clientele that is prepared to pay extra for improved disinfection. This exploratory study looks into if such a market exists and, if it does, how much more these consumers are ready to spend for improved disinfection.

Angela ( 2010) this study aims to assess the necessity of innovation as a strategy for gaining a competitive edge in the housekeeping (HK) division of five-star hotels in Dubai and examine how the region's industry presents unique difficulties.

## **2.2 Role of Technology in Housekeeping**

Technologies such as automated cleaning equipment, IoT sensors, and digital checklists have optimized cleaning operations across various sectors. According to Gupta and Mehta (2022), smart housekeeping systems reduce labour fatigue and enhance cleaning standards through data-driven operations.

Kumawat et.al., (2025)Artificial intelligence has completely changed the hospitality business by being incorporated into its operations, yet little research has been done on how employees use AI.

Vatan and Dogan (2021) The purpose of this study is to ascertain how Turkish hotel staff members feel about service robots. Forty in-depth interviews with hotel staff members from various departments were used to gather data. Thematic analysis was used to analyse the data. The findings showed that hotel staff members had unfavourable feelings when they heard the word "robot." Although hotel staff believe that service robots could offer various advantages and benefits to both employees and businesses, they also think that service robots could cause some issues when communicating with customers. The hotel staff also believes that future unemployment will rise as a result of service robots

According to Gonzalez et.al., (2021) the fight for dignity in hotel housekeeping among Spanish room attendants is examined in this article. It highlighted Las Kellys' joint efforts to combat stigma and elevate room attendants' labour. The political concept of "subversion tactics" and a multi-level conceptualisation of dignity in tourism employment served as the foundation for the qualitative, digital ethnography, which included 40 semi-structured interviews, internet observation, and documentary analysis. The research shows that Las Kellys uses three subversion strategies that affect three distinct but connected levels: housekeeping as the centre of the value chain (organisational level), Las Kellys as a socio-political agent (socio-political level), and room attendant as a skilled and fulfilling job (occupational level).

Syed et.al (2025) evaluated their combined influence on value creation in the Malaysian hospitality sector, this study investigates the connections between technology readiness, AI adoption, dynamic capacities, sustained competitive advantage, and technological turbulence. The study examines the contributions of these strategic components to improving organisational performance using the Resource-Based View, Dynamic Capabilities Framework, and Contingency Theory. Data was gathered from 336 respondents using stratified purposive sampling.

Shin et.al., (2022) stated that understanding how customers interact with hospitality and tourism technologies has become crucial as new and developing technologies continue to change consumer environments and operations in these sectors. The purpose of this study was to create a conceptualisation of how customers interact with hospitality and tourist technologies that is theoretically sound. This study theoretically defined and conceptualised consumers' technology experience as a second-order formative construct with nine dimensions (sensorial, cognitive, pragmatic, emotional, relational, unique, familiar, controllable, and economical experiences) using a sequential exploratory approach and scale development procedures.

Bas (2025) highlighted that state of developing technologies, their potential for curriculum integration, the skills that students can learn from them, and the job prospects they generate in the travel and hospitality sector are all examined in this article. In order to investigate the role of emerging technologies in the curriculum, the study first performed a content analysis of the curricula of 65 undergraduate tourism and hospitality management programs. Next, data from 28 academics

was analysed. We have seen six main subjects. The lowest percentage was found in technology courses. We also note four skill categories that students could acquire from emerging technologies, emphasising how they could influence future employment prospects.

Sharma (2019) stated that technology is playing a vital role in housekeeping in different facilities like hotels, hospital, malls etc with cleaning apps, Robo – cleaners.

According to Muthugala et al., (2020) Robots for cleaning are employed to meet the needs of both residential and commercial spaces. Numerous studies are being carried out to enhance the capabilities and effectiveness of cleaning robots. Human-friendly interactive features are preferred by users of these functional robots. As a result, in recent years, the emphasis of cleaning robot research has shifted from enhancing fundamental cleaning-related capabilities to including interactive elements that are favourable to humans.

Chandana & Saurabh (2024) mentioned in the study that using technology in hotel Housekeeping is not new but covid has played a pivotal role in making housekeeping more tech savvy.

*(View of From Tech Novice to Tech Savvy – A Review on Hospitality Housekeeping.Pdf, n.d.)*

### **2.3 Customer Expectations Post-Pandemic**

Consumer studies indicate a shift in expectations post-pandemic, with cleanliness perceived as a non-negotiable service quality attribute Rao et al., (2021). Patrons now look for visible and traceable cleaning practices supported by technology.

Elshaer (2023) mentioned in the study that due to travel restrictions and lockdown measures, the COVID-19 pandemic has had a significant negative impact on the tourism industry, leading to economic losses and job losses. Employees in the tourism industry have been particularly affected, including greater stress at work, financial hardships, and job uncertainty. These workers' mental health and quality of life (QOL) have also suffered greatly as a result of the pandemic, with high levels of stress, anxiety, and sadness.

Song et al., (2022) stated that hotel business has been affected in every way by the coronavirus disease (COVID-19). Nonetheless, more focus should be paid to the shifts in hotel patron pleasure. This study compares the determinants of customer satisfaction before and after the COVID-19 pandemic using online hotel reviews. Factors influencing consumer satisfaction and emotional strength both before and after the COVID-19 pandemic are extracted through sentiment analysis and Latent Dirichlet Allocation. After that, several regression models are created in order to compare how each feature affects hotel patron satisfaction over time.

Jenny & Han (2022) highlighted that the impact of the COVID-19 pandemic on hotel selection characteristics and consumer post-purchase behaviours is examined in this study. Both qualitative and quantitative methods are employed in an importance-performance analysis.

### **2.4 Gaps in Research**

While there is significant research on housekeeping in hotels, limited studies focus on multiplexes—a sector with unique cleaning challenges such as frequent turnover, high footfall, and time-sensitive cleaning windows.

## **3. Research Methodology**

### **3.1 Objectives**

- To study the latest technological tools used in multiplex housekeeping.
- To evaluate customer satisfaction levels related to tech-enabled cleaning.
- To assess operational advantages of using technology in housekeeping practices.

### 3.2 Research Design

A **descriptive research design** was adopted. Both primary and secondary data were used for the research. The data was collected from 150 respondents of multiplex customers and 25 housekeeping managers & executives from multiplexes of Gurgaon.

Questionnaire of customer satisfaction was filled by 150 respondents and semi structured interview with HK managers was collected for the research analysis

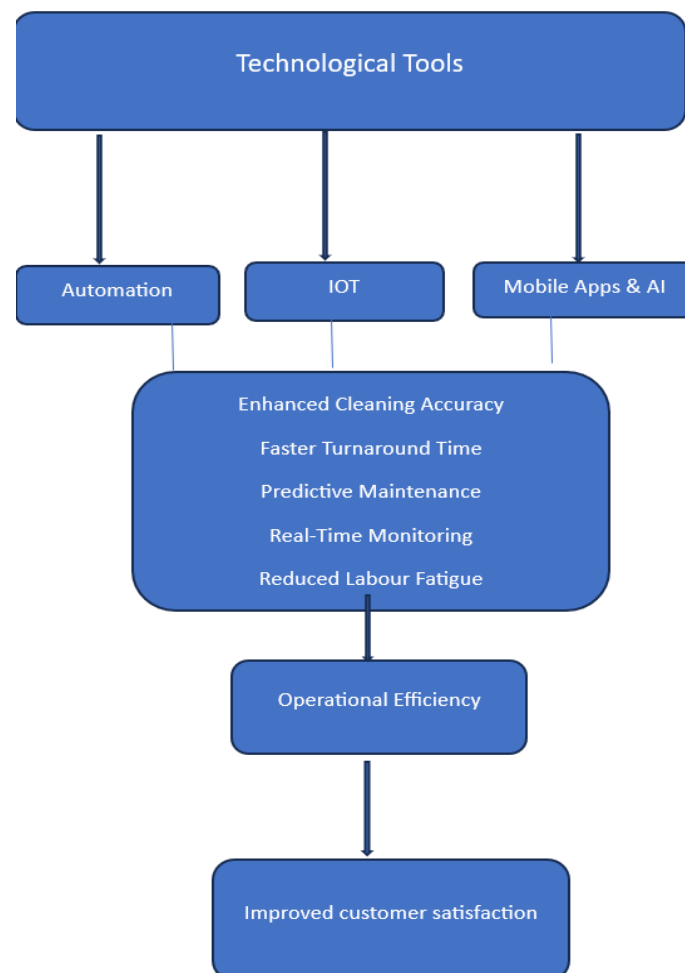
### 3.3 Data Analysis Techniques

Statistical tools such as **correlation analysis**, and **SWOT analysis** were used to analyse the customer satisfaction survey with respect to the use of technology for a hygienic standard maintained in multiplexes.

## 4. Data Analysis

### 4.1 Conceptual Model: Tech-Enabled Housekeeping in Multiplexes

This model demonstrates the relationship between technological enablers in housekeeping and their impact on operational efficiency and customer satisfaction in multiplexes.



**Fig 1 Conceptual model**

As per the structured interview conducted with housekeeping managers it was found that the Technological tools in Multiplex housekeeping are really beneficial as the cleaning time in auditorium is very limited and the turnaround time for Audi is very less this is the reason why technological tools like Robotic cleaners UVC sanitisers & sensor-based system becomes very helpful.

Automated Vacuum Bots for Audi cleaning to minimise the TAT.

IOT & sensors like Trash level sensors, washroom usage monitors, air quality trackers decrease the cleaning time and increases guest satisfaction also Mobile apps like Staff scheduling, digital SOPs, alert systems, predictive cleaning analysis plays a very important role in increasing the departments performance.

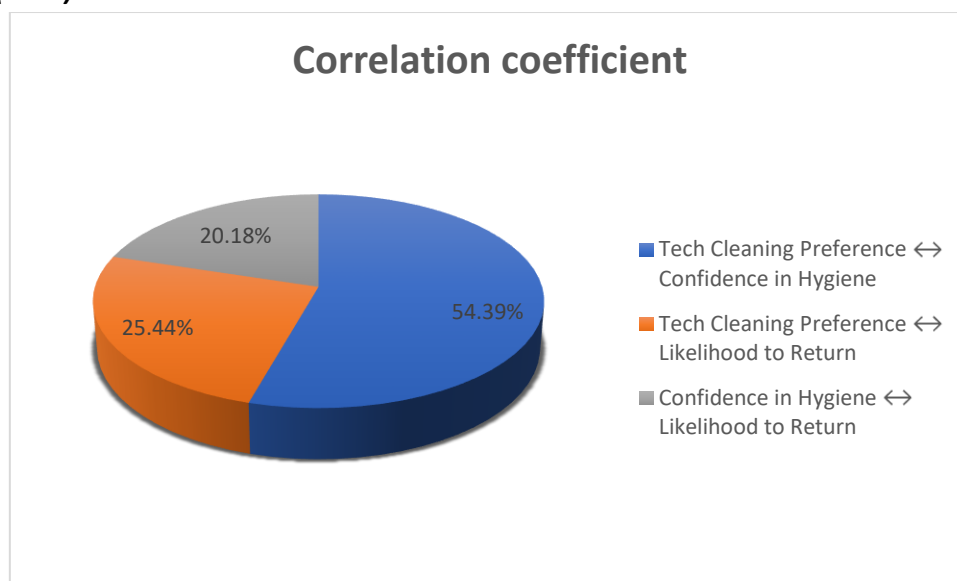
Alo as per the customer survey the tech based cleaning has a positive impact on customer and their willingness to return to the multiplex to watch movies, the survey also shows a positive impact on customer confidence towards hygiene practices followed in multiplexes.

<b>4.2 Highlights of the Customer Survey</b> Variable pair	Correlation coefficient	Interpretation
Tech Cleaning Preference ↔ Confidence in Hygiene	0.69	<b>Strong positive correlation</b> — As preference for tech-based cleaning increases, confidence in hygiene practices also tends to increase significantly.
Tech Cleaning Preference ↔ Likelihood to Return	0.29	<b>Moderate positive correlation</b> — A mild relationship indicates that a preference for tech-cleaning may slightly influence the likelihood of customers returning.
Confidence in Hygiene ↔ Likelihood to Return	0.23	<b>Positive correlation</b> — Increased confidence in hygiene has a small, yet positive effect on customers' willingness to revisit.

**Table no.1 Correlation Matrix (Customer)- Tech based cleaning & customer satisfaction**

**Interpretation:**

- Tech-based cleaning preference is moderately to strongly associated with confidence in hygiene practices.
- Likelihood to return has a weaker, yet positive correlation with both hygiene confidence and tech preference.
- This suggests that:
  - Customers who prefer tech-based cleaning tend to trust hygiene practices more.
  - That trust slightly increases their willingness to revisit the multiplex.



**Fig 2 Representation of Customer perception**

#### 4.3 Housekeeping staff Responses

Variables	Reduced Labour Time	Faster Audi Cleaning	Reduced Complaints	Tech-based Hygiene Practices & Customer Satisfaction
Reduced Labour Time	1.00	0.79	0.63	0.63
Faster Audi Cleaning	0.79	1.00	0.61	0.71
Reduced Complaints	0.63	0.61	1.00	0.73
Tech-based Hygiene Practices Improve Customer Satisfaction	0.63	0.71	0.73	1.00

**Table no 2 Correlation matrix (Housekeeping Staff) – Relationship of tech-based cleaning with Customer Satisfaction& operational efficiency**

#### Interpretation

The analysis shows a strong relation between tech enable hygiene practices and customer satisfaction. There is strong relation between reduced labour time with other variables which suggest that tech-based cleaning has a strong influence on operational efficiency and perceived customer satisfaction.

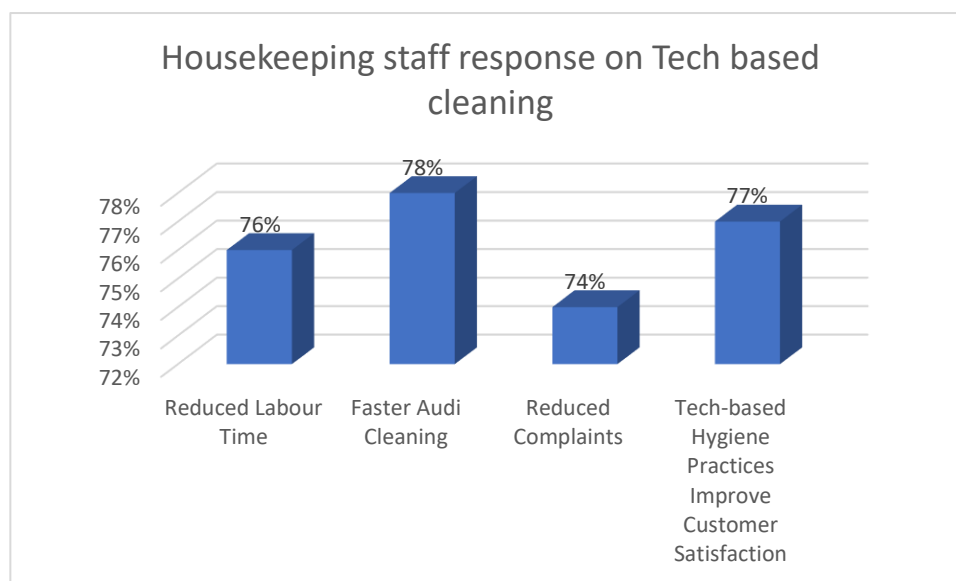


Fig 3 Housekeeping staff response

#### 4.4 SWOT Analysis Summary

Strengths	Weaknesses
Quick turnaround	initial outlay of funds
Enhanced responsibility	Technical instruction is necessary.
Planning supported by data	Technology dependent Possibilities Dangers
Opportunities	Threats
CRM integration Network	power outages
Instantaneous feedback	Opposition to change

#### 5. Findings

Multiplex housekeeping technological tools, like as cleaning applications, UV-C robots, and sensor-based alarms, greatly increase operational efficiency.

- Customer satisfaction and Tech based cleaning in Multiplex have a positive link
- Improvements in cleaning turnaround time and labour allocation by using tech-based cleaning tools were noted by housekeeping managers.
- Particularly in the post-pandemic environment, consumers link tech-based cleanliness to dependability and safety.

## **6. Conclusion and Recommendations**

According to the study's findings, incorporating technology into multiplex housekeeping improves both operational efficiency and patron perceptions of cleanliness. Using smart housekeeping systems is now required since multiplexes are vying for customers' attention. It is advised that movie theatre proprietors make investments in:

- Robotic cleaning apparatus
- Sensor-based garbage and lavatory surveillance
- Digital housekeeping management training programs and real-time customer Feedback systems

The research emphasises how technology is revolutionising housekeeping standards in multiplex settings. Cleaning, operational efficiency, and customer happiness have all increased dramatically with the use of tech-based solutions including automated cleaning equipment, sensor-based lavatory monitoring, IoT-enabled inventory management, and real-time feedback systems.

According to research, multiplexes that have implemented cutting-edge housekeeping technologies have seen increases in customer loyalty and perception in addition to better hygiene ratings and audit compliance. Additionally, technology has facilitated data-driven decision-making, decreased reliance on human labour, and improved resource management. Nevertheless, the study also points up difficulties such exorbitant implementation costs, a shortage of qualified personnel to manage new technologies, and sporadic system malfunctions. To fully realise the potential of technology in the cleanliness domain, these issues require strategic attention.

### **Recommendations**

1. Investment in Smart Infrastructure: Multiplexes should devote money to implement tech-enabled solutions like robotic floor cleaners, UV sanitation devices, and occupancy sensors for toilets to maintain constant cleanliness.
2. Training and Upskilling: To introduce housekeeping employees to new technologies and foster a tech-adaptable culture, regular training sessions must be held.
3. Integrated Monitoring Systems: Better accountability and transparency will be achieved by putting in place centralised dashboards to track cleaning schedules, audit results, employee attendance, and consumables in real-time.
4. Consumer Feedback Integration: To better grasp consumer impression and quickly fill up any gaps, promote digital feedback via QR codes or applications after services.
5. Sustainability Focus: To comply with health and environmental regulations, use chemical-free sanitation options and green cleaning methods.
6. Pilot Programs Before Full-Scale Rollout: Test new housekeeping technologies in selected branches to quantify ROI, assess operational impact, and assure scalability.
7. Cooperation with Tech Providers: To obtain ongoing maintenance, customisation, and support for deployed systems, collaborate with facilities management tech firms.

### **References**

- [1] Aguilar-Escobar, V. G., Garrido-Vega, P., Majado-Márquez, J., & Camuñez-Ruiz, J. A. (2021). Hotel room cleaning: Time study and analysis of influential variables in a Spanish hotel. *Journal of Industrial Engineering and Management*, 14(3), 645–660. <https://doi.org/10.3926/jiem.3441>
- [2] Angela, A. (2010). Assessing the future of housekeeping operations in Dubai's five-star hotel industry – room for innovation? *Worldwide Hospitality and Tourism Themes*, 6(iss 4), 352–361.
- [3] Bas, M. Y. (2025). *Sport & Tourism Education Integration of emerging technologies in tourism and hospitality curriculum : An international perspective*. 36(May 2024). <https://doi.org/10.1016/j.jhlste.2025.100546>
- [4] Elshaer, I. A. (2023). Heliyon Front-line hotel employees mental health and quality of life post COVID-19 pandemic : The role of coping strategies. *Heliyon*, 9(6), e16915. <https://doi.org/10.1016/j.heliyon.2023.e16915>
- [5] Gupta, R., & Mehta, N. (2022). *Smart Housekeeping: A Future Trend in Hospitality*. *Journal of Facility Management*, 18(2), 124–135
- [6] Jenny, J., & Han, H. (2022). *International Journal of Hospitality Management Saving the hotel industry : Strategic*



- response to the COVID-19 pandemic , hotel selection analysis , and customer retention. *International Journal of Hospitality Management*, 102(August 2021), 103163. <https://doi.org/10.1016/j.ijhm.2022.103163>
- [7] Kumar, S. (2020). *Clean Cinemas: The Role of Housekeeping in Entertainment*. *International Journal of Hospitality and Tourism*, 10(3), 56–67.
- [8] Kumawat, E., Datta, A., Prentice, C., & Leung, R. (2025). International Journal of Hospitality Management Artificial intelligence through the lens of hospitality employees : A systematic review. *International Journal of Hospitality Management*, 124(October 2024), 103986. <https://doi.org/10.1016/j.ijhm.2024.103986>
- [9] Muthugala, M. A. V. J., Vengadesh, A., Wu, X., Rajesh, M., Iwase, M., Sun, L., & Hao, J. (2020). Automation in Construction Expressing attention requirement of a floor cleaning robot through interactive lights. *Automation in Construction*, 110(November 2019), 103015. <https://doi.org/10.1016/j.autcon.2019.103015>
- [10] Rao, A., Sharma, K., & Patel, V. (2021). *Post-Pandemic Consumer Behavior in Multiplexes*. *South Asian Journal of Business*, 14(1), 43–52.
- [11] Sharma, L. (2019). *Technology in Housekeeping: A Review of Global Trends*. *International Facility Services Journal*, 22(4), 89–101.
- [12] Song, Y., Liu, K., Guo, L., Yang, Z., & Jin, M. (2022). Journal of Hospitality and Tourism Management Does hotel customer satisfaction change during the COVID-19 ? A perspective from online reviews. *Journal of Hospitality and Tourism Management*, 51(March), 132–138. <https://doi.org/10.1016/j.jhtm.2022.02.027>
- [13] *View of From Tech Novice to Tech Savvy – A Review on Hospitality Housekeeping.pdf*. (n.d.).
- [14] Zemke Dina Marie V, Neal Jay, Shoemaker Stowe, & Kirsch Katie. (2015). Hotel cleanliness: will guests pay for enhanced disinfection? *International Journal of Contemporary Hospitality Management*, 27(4), 690–710.
- [15] Vatan, A., & Doğan, S. (2021). What do hotel employees think about service robots? A qualitative study in Turkey. *Tourism Management Perspectives*, 37, 100781. <https://doi.org/10.1016/j.tmp.2020.100781>