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EXAMINING THE REASONS AND POTENTIAL APPLICATIONS OF IOT TECHNOLOGY FOR THE HOTEL INDUSTRY IN BANGLADESH

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ABSTRACT

With different industries, hospitality businesses stand to benefit significantly from the development of the Internet of Things (IoT). The research examines various potential applications for IoT, as well as the factors that led the hotel industry in Bangladesh to adopt the technology. The main issue raised by the statement of the problem is that Bangladeshi hotels need to integrate technology well, which results in poor service, dissatisfied customers, and inefficient operations. To give hotels a competitive edge in the market, this research aims to investigate how IoT can improve these areas. Examining scholarly publications, industry reports, and case studies about IoT technology in Hospitality, the study's main methodology was a literature review. With this method, the main drivers, obstacles, and possible uses of IoT in the Bangladeshi hotel sector were to be identified. The results emphasize that IoT can extensively improve guest experiences by enabling tailored services, enhancing security measures, and streamlining operations through automation. However, lack of technical expertise, challenges such as high execution costs, and concerns over data privacy were also identified. The key findings indicate that while the potential for IoT in the Bangladeshi hotel industry is extensive, successful accomplishment requires investment in infrastructure, strategic planning, and addressing the identified challenges. The study concludes with recommendations for policymakers and business stakeholders to advance IoT adoption, aiming to raise the standard of hospitality services in Bangladesh.

INTRODUCTION

The hotel sector is transforming to adopt modern technology, such as the Internet of Things (IoT). IoT is an amazing network that uses technology to connect to anything, anywhere, at any time, and to address problems by offering good connectivity. IoT is a network that uses 5G/4G/3G mobile communication, WSN (Wireless Sensor Network), RFID (Radio Frequency Identification), and added technologies to connect with anything, anytime, anywhere, by a predetermined protocol. This allows smart objects to be identified, located, tracked, monitored, and managed (Mingjun et al., 2012). The Internet of Things presents new prospects for establishing connections between the virtual and physical realms. It facilitates enhanced direct and active interaction among travelers, hotels, products related to tourism, and destinations (Car, Stifanich, & Šimunić, 2019). In his 1999 presentation to Procter & Gamble (P&G), Kevin Ashton introduced the term "Internet of Things," which is also referred to as "cyber-physical systems" on a larger scale (Ashton, 2009). IoT has a lot and intriguing possibilities. Examples include automated check-in procedures, predictive repair of hotel equipment, and smart rooms that modify temperature and lighting according to visitor preferences. This study aims to examine the reasons behind the adoption of IoT technology in the hotels of Bangladesh. It also investigates IoT's potential applications in hotel businesses. A comprehensive literature review is conducted; the research seeks to provide insights into how IoT can be leveraged to face challenges in the hotel industry. The study also considers the broader implications of IoT adoption, including its impact on competitiveness in the global market and the future of Hospitality in Bangladesh.

Utilizing IoT in hotels is a pressing issue nowadays to delight guests, stay in line with the global hotel industry, and manage operations efficiently. However, can IoT technology be introduced into Bangladeshi hotel businesses? One must examine IoT's advantages and practical applications to answer this issue. As a result, analysis and discussion of the

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benefits and methods of IoT justify the paper. The main goal of this study is to check if adopting IoT technology in Bangladesh's hotel business is acceptable. Ultimately, the findings of this research will contribute to a better understanding of the adoption of IoT and offer practical recommendations for industry stakeholders looking to embrace this transformative technology.

LITERATURE REVIEW

Internet of Things (IoT) makes monitoring and operating complicated systems easy, boosting productivity and lowering operating expenses. It facilitates proactive decision-making by enabling real-time data collecting and analysis, which drives innovation and improves service delivery. IoT is revolutionizing various sectors by connecting devices and systems for enhanced communication and functionality. In the words of Khamesra and Priya (2017), the Internet of Things is a term that refers to smart connections that allow items to exchange and gather data. The Internet of Things, or IoT, is experiencing rapid development (Alam, 2018; Ghosh et al., 2018; Perwej et al., 2019). According to Zhong, Zhu, and Huang (2015) and Miorandi, Sicari, Pellegrini, and Chlamtac (2012), IoT enables authorized users to access devices anywhere. The Internet of Things (IoT) comprises sensor-based technologies, including wireless and QR Codes (Cui et al., 2021; Hussain et al., 2020). This technological advancement has significantly affected many industries by enabling everyday objects to exchange data. The Internet of Things (IoT) is growing as businesses look to increase performance with customer satisfaction. It offers novel solutions and game-changing advantages. Many devices have been attached to the Internet since the introduction of the Internet of Things. These devices can detect their environment, share information, and carry out tasks. People's daily lives have begun to include IoT (Vashi, Ram, Modi, Verma, & Prakash, 2017; Atzori, Iera, & Morabito, 2010), which is also making their lives more pleasant (Shah & Yaqoob, 2016).

IoT is rapidly gaining a role in effective business strategies in every industry, from manufacturing to agriculture. Businesses are investing in IoT solutions, a growing sector trend (Skelia, 2018). Despite several current challenges, IoT is becoming a vital component of business in the future across all industries, from manufacturing to agriculture (Gardašević et al., 2017). Modern technology can enhance sustainability, improve guest experiences, and optimize operations (Aromataris et al., 2015). The hospitality industry is no different. To improve customer satisfaction, obtain a competitive advantage, and boost operational effectiveness, IoT integration is crucial (Shani, Majeed, Alhassan, & Gideon, 2023). IoT integration will be vital in increasing customer happiness, establishing a competitive edge, and improving operational efficiency (Breidbach et al., 2018). Tourism is being revolutionized by IoT, which is making it more affordable, environmentally responsible, and customer-focused.

IoT is an innovative technology that has started to impact the hotel industry, according to Verman and Shukla (2019). Its goals are to increase customer pleasure, save costs, and generate business profit. With its unparalleled potential to improve guest experiences and optimize workflows, IoT has become a game-changer in the hospitality sector. IoT can be useful in hotel management, enhancing guest experiences and lowering operational and theft-related costs, despite specific privacy concerns surrounding Internet-of-things (IoT) technologies (Sousa et al., 2009; Kelly & Erickson, 2005; Turner, 2014). To develop smart settings that meet the changing needs of contemporary tourists, hotels, in particular, are utilizing cyberspace. By fusing the digital and physical worlds seamlessly, IoT technologies let hoteliers build individualized experiences that will amaze guests and unlock previously unheard-of levels of productivity and efficiency. IoT makes an unprecedented degree of service possible, from automated check-ins to customized room settings.

Technology has a significant impact on how guests' stays in hotels are enhanced, co-created, and customized. Some elements that guests expect to improve their experience are the daily itinerary planning data search and the ability to locate nearby activities and destinations. IoT hotel applications include automated check-in and check-out procedures, smart housekeeping, smart room service, and automation (Sharma & Gupta, 2021). One of the primary benefits of IoT in hotels is the ability to deliver personalized experiences. According to Sousa et al. (2015), some benefits include central monitoring, which enables insights into access log data and battery state, and remote functions like revoking keys and extending validity dates. IoT-enabled smart rooms can adjust the lighting, temperature, and entertainment selections according to guests' tastes. This personalization increases comfort and makes the stay unforgettable, promoting return business and excellent evaluations. Additionally, IoT-driven data collecting enables hotels to provide customized services and promotions by better understanding the behavior and interests of their customers. Another noteworthy benefit of IoT for the hotel business is operational efficiency—automated energy management solutions, such as smart lighting controls and thermostats, cut expenses and energy usage. IoT sensors facilitate predictive maintenance, which helps detect equipment breakdowns before they occur, reducing downtime and guaranteeing smooth operations. IoT also improves security by installing video cameras and smart locks, giving visitors peace of mind.

The impact of IoT on the hotel industry also extends to staff productivity. Sharma and Gupta (2021) claim that the Internet of Things fundamentally changes hotels and hotel businesses. Not only is the IoT enhancing the guest's experience, but it also benefits hotel employees. The hotel staff better understands the guests' needs and has a higher customer satisfaction rate. Thanks to the Internet of Things, the hotel lobby, kitchen, and rooms are all automated. With IoT-enabled devices, housekeeping and maintenance teams can receive real-time updates on tasks and inventory, improving coordination and efficiency. This streamlined communication reduces response times and enhances overall service quality.

Having reviewed the literature regarding IoT's applications and advantages, there is still significant room for improvement in discussing IoT's use in Bangladesh's hotel industry. Investigating IoT adoption in Bangladesh's hotel industry is vital for understanding how technology can optimize operations, improve guest experiences, and drive competitive advantage. This study offers insights into the potential benefits and implementation strategies, aiding the industry’s adaptation to global technological trends and enhancing its future growth prospects.

The study's basic objective is to determine whether IoT technology in Bangladesh's hotel industry is feasible. The benefits of IoT and how its approaches can be applied to run a business are assessed to determine feasibility. Therefore, the specific goals are to discover the advantages of IoT and determine the IoT solutions employed by hotel businesses globally.

MATERIALS AND METHODS

The development of the research involved the review of IoT technology literature. To finish the study, the literature from websites devoted to the hotel business, the hospitality industry, and other links are carefully examined and reviewed to learn about the diverse techniques used in IoT applications. The many advantages of IoT use are also investigated, as new technology adoption and application rely heavily on its benefits across all industries. The four most popular hotels in the world using IoT and additional links are used as the sample size for this purpose. Wynn Las Vegas and YOTEL Smart Hotel from the USA, ECCLESTON SQUARE from the UK, and W-SENTOSA COVE from Singapore are the hotels that were sampled. Customer attitudes toward IoT features, IoT automation facilities, IoT adoption, challenges and opportunities, impact of IoT, application, technology in the hospitality industry, potential benefits of IoT, opportunities to apply IoT to hotel business, and suggested future research directions for hotel business are all covered in this in-depth assessment of the literature. A survey based on content analysis was conducted for this study. Six bibliographic databases were used to compile the articles: IOPscinece, ResearchGate, ScienceDirect, Google Scholar, Semantic Scholar, and IEOM Index.

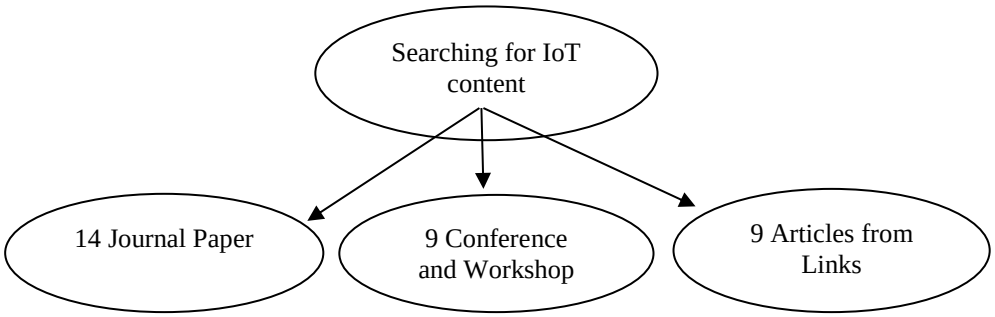

Figure 1. Methods to search for content in the Internet of Things (IoT).

DISCUSSIONS

Benefits of IoT in the Hotel Industry

The hotel sector is changing how it operates and serves its visitors through the Internet of Things (IoT). Automated room settings and easy check-ins are just two examples of individualized guest experiences made possible by IoT's ability to connect devices and systems. According to Maglogiannis, Iliadis, and Pimenidis (2020), there are three primary phases in which the Internet of Things enhances the guest experience: before, during, and following check-in. It also enhances operational efficiency through energy management, predictive maintenance, and real-time inventory tracking. Additionally, IoT improves safety and security with smart locks and advanced monitoring systems. As per Abd Latib et al. (2021) findings, IoT-connected systems are expected to enhance the hospitality sector by generating automatic energy savings, providing guests with increased comfort and ease, and benefiting hoteliers and operators through increased efficiency and customer satisfaction. As the hospitality industry evolves, IoT is crucial in meeting modern travelers' expectations while optimizing hotel operations for better service delivery and sustainability.

More Comfy Rooms

Making rooms more convenient and comfortable for visitors is one of IoT's key perks or advantages in hotels. Furthermore, there is a chance to provide improved experiences. In a scenario described by Aluri and Palakurthi (2011), the guest room has more automation and personalization. Devices can satisfy individual preferences to provide a better overall guest experience. Thermostats equipped with air quality, humidity, and temperature sensors are a few examples. This advantage is demonstrated by the fact that visitors using IoT technology can automate the control of numerous room functionalities. One of the personalized features is the ability for guests to control the lights with voice commands from their phone or tablet, for instance. Additional features may include the ability for the visitor to operate the TV, heating, or air conditioning from a fixed location without moving. Naturally, the consumer experiences ease and comfort from all of these amenities.

Enhanced Maintenance and Repairs

The benefits of the Internet of Things in hotels also include the development of the maintenance and repair department. Information can be gathered from objects or devices via the Internet of Things. Knowing the operational state of an air conditioner would be very helpful to the hotel maintenance team. Furthermore, sensors that display occupancy, energy, water use, and lighting status can be integrated with IoT. Knowing when to clean a specific room since it is unoccupied might be helpful for the cleaning crew.

Amplified Safety and Guest Convenience

Hotels boost security measures and real-time monitor properties using IoT-enabled sensors, smart control systems, and

advanced surveillance. Hoteliers can ensure guest safety by promptly responding to threats or emergencies through IoT (Acropolium, 2023). Because it makes it possible to install automatic locks, IoT in hotels also increases security and control. Typically, electronic cards that the visitor can keep in an electronic device are used to open these locks.

Innovative technology can assist hoteliers in meeting the demands of their mobile-first visitors, as most international tourists use their cell phones during their vacations. Guests can bypass lengthy lineups at the front desk by using contactless check-in services, which enable them to enter their rooms remotely from their smartphones. A digital keycard in a hotel's mobile app can support targeted advertising opportunities and encourage additional guest downloads. It also benefits hoteliers by freeing front desk workers to concentrate on other duties. Users will, therefore feel more secure when staying in a room equipped with these Internet of Things locks because they may use an application to unlock or lock the door. Furthermore, the entire hotel personnel will also be safer in addition to the guests. This is so that apps for linked devices may be developed using the Internet of Things, and in the case of a security breach, alerts can be sent to phones and other devices.

Voice-Activated Guest Support

Voice-activated guest service is another advantage of the Internet of Things in hotels. Customers can use voice commands to place food orders, request assistance, schedule a time for the spa, or reserve a table in the restaurant. Many hotels utilize this IoT benefit because it is an additional means of creating a better user experience.

Location-Based Information

Beacon, GPS, and Bluetooth technologies have all created new avenues for location-based information delivery. The hotel can use this to deliver guests communications at the exact moment when they will be most beneficial. This could entail informing clients via SMS about the restaurant's menu items when they are nearby or promoting gym services when they are close to the gym. It could also entail providing the most recent information about surrounding attractions or public transportation to assist the visitors.

Sustainability

Nowadays, selecting an environmentally friendly hotel is an essential consideration for travelers. Hoteliers are using IoT technologies to help save energy and promote green initiatives as more and more guests consider environmental issues. Using occupancy sensors lets hoteliers set off energy-saving features like lights out and temperature adjustments when a visitor vacates the room or checks out. These systems can link with a property's access control to automatically alter room temperatures when a guest checks in, maximizing energy savings without compromising guest comfort. Hecht et al. (2014) identified the opportunity for IoT to reduce in-room power consumption through light and climate control. This is because connected devices can make more intelligent decisions, such as having a thermostat that turns on energy-saving mode when a guest leaves the room and prepares the room for his return the moment he enters the elevator, detected by the guest's phone using micro-location capabilities (Chamarti, 2016).

Hotels use smart monitoring equipment to proactively implement solutions to save wasted energy, such as detecting potential water leaks, poor air quality, or faulty Heating, Ventilation, and Air Conditioning (HVAC) systems. McMullen (2017) claims that the shower's temperature may be changed to suit guests' requirements while also allowing them to report leaks, tank conditions, and other issues to the personnel so that appropriate action can be taken. Proactive maintenance programs assist properties in preventing equipment failures, while keyless access and contactless guestroom controls can reduce the amount of paper and plastic used across the property.

Inventory Management

IoT revolutionizes hotel inventory management by providing real-time tracking, automating stock control, and reducing manual errors. It ensures optimal inventory levels, minimizes waste, and streamlines operations, ultimately enhancing efficiency, reducing costs, and improving guest experiences. IoT has changed the hotel inventory management process. Systems that use the Internet of Things maintain an inventory log and automatically handle modifications (Car, Stifanich, & Simunic, 2019).

Use of IoT by the Famous International Hotels

Worldwide, numerous hotels currently employ hospitality IoT technologies to meet requests from guests, meet their needs, and enhance overall service.

Table 1. Top hotels adopting IoT globally

Name of the Hotel	Country	Provided IoT solution
ECCLESTON SQUARE	UK	Providing an innovative and “smart” ecosystem in its room
W-SENTOSA COVE	Singapore	Voice assistant and smart lighting system
Wynn Las Vegas	USA	Equipped with Alexa, a voice-controlled personal assistant
YOTEL Smart Hotel		Use of Robots to do small service tasks, delivering fresh towels to guests and taking their bags to storage

The globally renowned hotels that have already implemented various IoT technology strategies are listed in Table 1. The four hotels that have been identified are operating to increase customer happiness and gain operational efficiency.

Eccleston Square

Eccleston Square has implemented IoT strategies to enhance the guest experience. The hotel's Swedish-made beds can be adjusted using remote control, providing a massage function and automatic shut-off after 30 minutes. Rooms are controlled via panels on either side of the bed, including do not disturb signs, curtains, and lights. Temperature control is also available on the wall. Smart 4K TVs with amenities like Self-Check-Out and Room Service are available, along with apps like TV on demand, YouTube, Spotify, and Wake-Up. The built-in Chromecast allows guests to reflect their phones and tablets on the TV.

The study "Innovative service experiences of travelers visiting high-tech hotels: The case of Eccleston Square Hotel, London" was conducted by Cakar and Aykol (2019); they talked about the Internet of Things application at that specific hotel and mentioned that it includes smart IoT sensors and gadgets, like tablets that can be used to read electronic newspapers or place service requests directly from the room. Additionally, the hotel features smart TVs hidden behind the bathroom mirrors. Bowo, a tablet that functions as a service catalog and in-room concierge, is included in every accommodation. It allows guests to browse nearby restaurants, read reviews, and make online reservations. Bathroom mirrors and Smart Class function provide privacy. The Eccleston Square Hotel also offers a group WhatsApp conversation via QR code scanning.

Figure 2. TVs built-in bathroom mirrors.
Source: https://shorturl.at/zwGhd

W-Sentosa Cove

Because of its energy-efficient LED lighting and architectural design, W-Sentosa Cove is a brilliant hotel. The same guest loyalty apps allow customers to customize the lighting, mood, and music to create the ideal atmosphere. Additionally, this hotel includes an integrated voice assistant that reacts to requests instantly.

W-Sentosa Cove used an intelligent lighting system within an innovative energy management system to cut energy consumption and expenses dramatically. It is based on data from occupancy sensors and other Internet of Things devices. To enhance energy management, networked devices can communicate with one another to initiate actions like turning on or off the lighting across the hotel.

W-Sentosa Cove uses voice assistant technology in each guest room to provide instant access to information about the hotel and the surrounding area. In addition, visitors can use their voices to adjust the lighting and temperature in their rooms.

Wynn Las Vegas

Alexa for Hospitality, a voice assistant technology that Amazon launched in 2018, enables guests to utilize amenities and services from the comfort of their rooms with just verbal requests like "Alexa, order room service!" (Weldhen, 2022). Wynn Las Vegas uses Amazon Alexa, a virtual assistant that serves as each visitor's assistant. Because it is speech-enabled, visitors may use voice commands to order food from the hotel restaurant, call housekeeping, or change the room lighting and temperature. Guests can ask Alexa any inquiries they may have about Wynn and Encore, as well as to change the temperature, lights, and drapes in their rooms. The Internet of Things (IoT) powers Alexa, which uses machine learning to provide a personalized experience. This refers to a smooth integration with a hotel's front desk, housekeeping, concierge, and back office systems. Alexa is employed in the hospitality sector to set up personalized Echo devices that function as a digital concierge directly in the room. These Echos are trained to respond to inquiries concerning customer reservations, availability of amenities like a pool or spa, and nearby services. Visitors may also request housekeeping or room service. Alexa can handle anything, prompting guests to use the in-room phone to ask for assistance.

Figure 3. Amazon Echo Dot: Alexa-enabled device
Source: https://shorturl.at/cNUlo

YOTEL Smart Hotel

The YOTEL Smart Hotel uses robotic equipment, innovative room technology, and artificial intelligence. Robots can assist with daily tasks, including luggage delivery, housekeeping, room service, and guest greeting. In their paper, Kim and Han (2020) describe how YO2D2, a robot butler, welcomes visitors and assists with everything from room service to music playing at the YOTEL Hotel in Atlanta. Even more, the robot can operate the elevator and give directions. It can be configured to carry out several functions, such as food and drink delivery. When guest rooms are still occupied or have not been cleaned, it can assist with luggage storage and even entertain guests by dancing routines. At Yotel New York, Yobot, the robotic luggage handler, can manage up to 300 daily items. Yobot saves hotel employees time and money by allowing them to focus on other tasks.

Findings of the Study

There are many advantages to integrating IoT in the hotel sector, including increased guest satisfaction and operational effectiveness. One of the main advantages is the capacity to offer a highly customized visitor experience. Hotels can create a personalized atmosphere that enhances guest pleasure by adjusting room settings, including lighting, temperature, and entertainment, based on individual preferences, thanks to IoT-enabled smart devices. This customization continues throughout the check-in and check-out procedures, where the Internet of Things (IoT) enables smooth, contactless interactions. This greatly improves ease by allowing guests to check in using mobile apps and access their rooms using digital keys.

A further noteworthy benefit of using IoT in hotels is operational efficiency. Smart lighting, occupancy sensors, and thermostats are just some of how Internet of Things (IoT) systems boost energy management. These systems minimize environmental impact and utility costs by lowering energy use in unoccupied areas. Another essential advantage is proactive upkeep, in which Internet of Things devices constantly track the state of vital machinery like plumbing, elevators, and HVAC systems. Because of the early identification of possible problems made possible by this real-time monitoring, maintenance staff can take action before expensive breakdowns or service interruptions occur. IoT also makes effective inventory management easier by monitoring how consumables like small bar items and toiletries are used, guaranteeing prompt restocking and cutting down on waste.

In the hotel business, IoT greatly improves security and safety as well. Guest rooms can now have greater security because of smart locks, which can be operated by smartphones or biometric authentication. This eliminates the hazards that come with using standard key cards. Real-time monitoring is provided by IoT-integrated security systems, allowing for prompt reaction to any emergencies or possible threats. Environmental sensors monitor and notify personnel of temperature, humidity, and air quality changes, which help maintain a healthy interior environment.

Different strategies are used in hotels to optimize the advantages of IoT. Hotel employees may monitor and operate all linked equipment from a single platform using centralized control systems, increasing productivity and response times. IoT-powered data analytics provides insights into guests' operational patterns and behavior, empowering hotels to customize services to suit individual needs and make well-informed decisions. Hotel operations may be managed more intelligently and proactively when AI is integrated with IoT technologies, improving automation and predictive capabilities. In general, IoT adoption in the hotel sector promotes creativity, effectiveness, and a better visitor experience, positioning lodging facilities to satisfy the changing needs of contemporary tourists.

CONCLUSIONS

Integrating IoT technology in the hotel industry can provide significant advantages, specifically in augmenting guest experiences, streamlining operational procedures, and bolstering safety and security. Hotels can deliver better service while cutting costs and boosting sustainability due to IoT's sophisticated security measures, energy management, tailored services, and predictive maintenance. The usefulness of IoT is further increased by integrating AI, data analytics, and centralized control systems, which help hotels remain competitive in a market that is changing quickly.

Adopting IoT offers Bangladesh's hotel industry a huge chance to improve operational effectiveness and service standards. IoT implementation can assist hotels in meeting the rising expectations of tech-savvy tourists by providing smooth, personalized experiences as the nation's tourism sector expands. IoT-powered energy management is critical in Bangladesh, where energy conservation is vital. Hotels can use IoT to save energy costs and further sustainability objectives. Moreover, IoT's predictive maintenance capabilities might be beneficial in maintaining good service standards economically, which is crucial for Bangladesh's competitive hotel industry. IoT integration with current technologies will be advantageous. Hotels in Bangladesh may raise customer satisfaction, boost operational effectiveness, and establish themselves as leaders in the hospitality sector by investing in IoT and using it strategically.

This study makes a distinctive contribution by revealing how the Internet of Things technology can be tailored to enhance operational effectiveness and guest satisfaction in the hotel sector in Bangladesh. The study offers the groundwork for future technology developments in the hospitality industry by providing hoteliers in Bangladesh with a guide on adopting IoT.

The study offers a framework for IoT adoption, guiding hotel managers in improving efficiency, innovation, and guest satisfaction in Bangladesh. This study also proposes a foundation for further scholarly research in this field and the broader application of IoT in Bangladesh's hotel industry.

The hotel industry's adoption of IoT technology is still in the early stages. Surprisingly, few hotels worldwide operate with relatively small IoT connections. The study is impacted by limited access to advanced IoT data. Future research

could explore IoT implementation models, long-term cost-benefit analysis, and comparative studies with other developing nations to refine strategies for successful technology integration in the sector.

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