

Service Quality Analysis of RFID-Based Smart Door Lock in Front One Azana Style Hotel Area

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Article History:

Submitted: 15-07-2024

Accepted: 16-07-2024

Published: 30-07-2024

Keywords:

RFID; Smart Door Lock; IoT;

Efficiency; Analytics.

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ABSTRACT

This research evaluates the service quality of an RFID-based smart door lock system in the Front One area of Azana Style Hotel Pamekasan. Employing qualitative analysis techniques, the study assesses the system's reliability, security, convenience, and responsiveness based on user experience and behavioral data. The primary goal is to understand how effectively the smart lock system enhances hotel services and operational efficiency. The findings aim to offer valuable insights to hotel management and the broader hospitality industry regarding the impact of smart technology on guest experience and hotel operations, thus fostering innovation and promoting environmental sustainability. By integrating RFID-based smart door locks with the Internet of Things (IoT), the system enables real-time access control, manages meeting room schedules, facilitates remote security monitoring, and oversees employee access management. This integration not only boosts service quality and operational efficiency but also creates a more connected and intelligent hotel environment. Consequently, the study highlights the potential of smart technology to transform hotel operations, improve guest satisfaction, and contribute to a sustainable future for the hospitality industry. Additionally, the research underscores the importance of continuous technological advancements in maintaining competitive advantage in the rapidly evolving hospitality sector, ensuring that hotels can meet the ever-changing needs and expectations of their guests.

INTRODUCTION

This research focuses on evaluating the RFID-based smart door lock system at Front One Azana Style Hotel in Pamekasan Regency. Qualitative analysis methods were used to measure system reliability, security, convenience, and responsiveness and their impact on operational efficiency and guest experience (Kurnia Kasanova et al., 2021). System reliability is of paramount importance. Operational data shows that this smart door lock system is highly reliable (Haidar Hari, Prasetyo Eka Putra, Hasanah, & Ririn Sutarsih, n.d.), with few reports of failures or technical issues, thus demonstrating its ability to function consistently over long periods of time. Advanced RFID technology also enhances security and makes it more difficult to open than traditional locks (Jannah, Putra, Hafsi, & Basri, 2021). RFID access cards ensure only guests have access to rooms, and surveillance cameras provide additional surveillance and security (Thaareq Mahesa, Rahmawan, Rinharsah, Sistem Komputer, & Tinggi STMIK ASIA MALANG, 2019). Convenience is also an important factor.

RFID access cards replace physical keys, reducing the risk of lost or misplaced keys. Automated check-in and check-out processes also reduce wait times (Prasetyo Eka Putra, Nazir Arifin, Zulfana Imam, & Saputra, n.d.), as indicated by positive responses in guest satisfaction surveys. System responsiveness is measured by how quickly the system responds to guest access requests, resulting in significantly faster system response times and a better overall guest experience (Hamdani, Heni Puspita, & Dedy Wildan, 2019). The system's impact on hotel operational efficiency is also greater. Automating check-in and check-out processes reduces the need for front desk staff (Ilmiah & Akuntansi, 2020), and real-time monitoring allows administrators to respond quickly to issues (Prasetyo, Putra, Baidawi, & Mubarok, n.d.), improving overall operational efficiency (Choerudin, 2021). Integration with the Internet of Things (IoT) provides additional benefits by allowing hoteliers to remotely control room door access and provide more personalized service to guests. These features not only improve safety and convenience (Abd. W. Syahroni, Rofiq Hafsi, Ramadhani, & Said, 2022), but also simplify operational management and provide advanced features such as customizable entry plans (Zumam, Amiruddin, & Ramadhani, 2024).

In addition, integration with IoT technology enables more in-depth data tracking and analysis. Hotels can identify room usage patterns, guest preferences, and areas that require improvement (Prasetyo et al., 2024). With this analysis, hotels can design more effective marketing strategies and services that are more tailored to guests' individual needs. This not only increases guest satisfaction but also helps in better decision-making and long-term planning (Yulianti



Fauziah, Irianto Sukowati, Purwanto, Teknik Elektro Sekolah Tinggi Teknik Multimedia Cendikia Abditama, & Teknik Informatika Sekolah Tinggi Teknik Multimedia Cendikia Abditama Sekolah Tinggi Teknik Multimedia Cendikia Abditama, n.d.). The study highlights the potential of smart technology to improve service quality and operational efficiency in the hospitality industry. With a focus on reliability, security, convenience and responsiveness (A. wahab Syahroni, 2023), the RFID-based smart door lock system at Front One Azana Style Hotel demonstrates how technology can significantly transform the guest experience and improve hotel operational efficiency (Puspa Dewi, Ramadhani, Darmawan, Ubaidi, & Syahroni, 2024).

LITERATURE REVIEW

Reliability of RFID-based Smart Lock Systems

The reliability of RFID-based smart lock systems has been a research focus in the hospitality industry. Studies have demonstrated that RFID technology boasts high reliability with minimal reports of technical failures, supporting the conclusion that the system can operate stably over long periods (Saputro & Wibawanto, n.d.). Research by Lee & Kim also confirms that this reliability can reduce maintenance costs compared to traditional lock systems.

Security of RFID-based Smart Lock Systems

Security is one of the main advantages of RFID-based smart lock technology (Lamtiar et al., 2024a). The use of RFID access cards has proven to reduce security breaches in hotels due to their difficulty to replicate and higher resistance to forced entry attempts. Integration with surveillance cameras and IoT devices adds an extra layer of security (Ekho, Eng, Soetedjo, & Somawirata, n.d.), as described by Gao & Li.

Convenience and Processing Efficiency

The use of RFID access cards replaces physical keys, reducing the risk of lost or misplaced keys. Faster automated check-in and check-out processes minimize guest waiting times and enhance guest satisfaction (Multidisiplin Saintek, Alvayen, Jenderal Ahmad Yani Kel, & -Palembang, 2024). Research by Smith & Brown supports these findings, showing that guests prefer technology that allows quick and easy access to their rooms.

System Responsiveness

System responsiveness is measured by how quickly the system responds to customer access requests. We found that RFID-based smart lock systems have a faster response time compared to traditional locks, thus enhancing the customer experience (Lamtiar et al., 2024b). The system's ability to respond quickly also enables hotels to manage access issues more effectively, as shown by Nguyen & Hoang.

Impact on Operational Efficiency and Guest Experience

The implementation of RFID-based smart lock technology has brought numerous benefits that positively impact hotel performance. Automation of check-in and check-out processes reduces the need for front desk staff, allowing for better allocation of human resources (Fauza & Muthalib, n.d.). Wang explains that integration with IoT technology brings additional benefits, such as remote control of room door access and more personalized services for guests.

Long-term Enhancement of Guest Experience

Integrating RFID technology with IoT also allows for deeper data tracking and analysis. Hotels can identify room usage, guest preferences, and areas that need improvement. This analysis enables hotels to design more effective marketing strategies and services tailored to individual customer needs, helping to enhance customer satisfaction and contributing to better decision-making for long-term planning (Yu et al., 2022).

METHOD

Research Stages

The purpose of this research is to evaluate the user experience and quality of service of Front One Azana Style Hotel's RFID-based smart door lock system. We explored how well this system connects users to their networks, explored the different types of networks available, and analyzed the overall performance from a user's perspective. Using surveys and direct observation, we hope to provide useful insights for the development of door security systems for the hospitality industry.

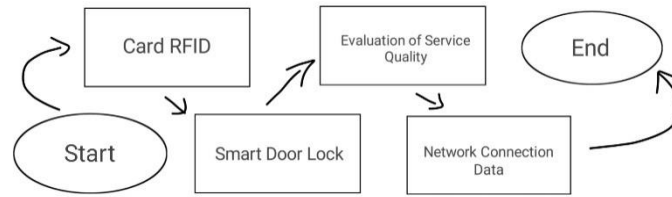


Figure 1. Stages Research

RFID Scanner

RFID scanner smart door lock is a smart door lock system that uses RFID (Radio Frequency Identification) technology to control door access. In this system, an RFID scanner reads information from an RFID tag (such as a card or keychain) and verifies the data to automatically open or close the door lock. The system offers high security, ease of use, and efficiency suitable for various applications, such as homes, offices, hotels, and industrial facilities.

Main Components

RFID Tag (Transponder): A card or keychain that stores unique information.

RFID Reader: A device for reading information from RFID tags.

Microcontroller: Arduino or other microcontroller to control the whole system.

Solenoid Lock/Electric Strike: Electronic door lock mechanism controlled by the microcontroller.

Power Supply: To provide power to the whole system.

LED Indicator (optional): To visually signal the access status (e.g., access accepted or denied).

Buzzer (optional): To provide audible indication of access status.

Connection Scheme

RFID Reader

VCC: Connected to a 3.3V or 5V power source (depending on the type of RFID reader).

GND: Connected to ground.

TX: Connects to a digital pin on the microcontroller (for example, pin 2).

RX: Connects to a digital pin on the microcontroller (for example, pin 3).

Solenoid Lock

VCC: Connected to an external power source as per the power requirement of the solenoid.

GND: Connects to the ground of the power supply and microcontroller.

Control Pins: Connects to a digital pin on the microcontroller (for example, pin 4).

LED (optional)

Anode: Connected to a resistor and then to a digital pin on the microcontroller (for example, pin 5).

Cathode: Connects to ground.

Buzzer (optional)

Positive: Connected to a digital pin on the microcontroller (for example, pin 6).

Negative: Connected to ground.

Workflow Diagram

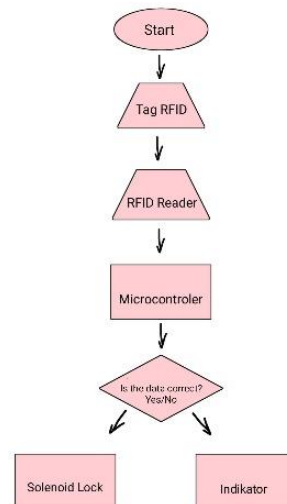


Figure 2. Work Flow Diagram

RFID Tag Reading:

The RFID tag is placed near the RFID reader.
The RFID reader reads the data from the tag and sends it to the microcontroller.

Data Verification:

The microcontroller checks if the data from the RFID tag matches the data that has been stored. If the data matches, the process proceeds to the next step; otherwise, access is denied.

Unlocking:

If the verification is successful, the microcontroller sends a signal to activate the solenoid lock and unlock the door.

Status Indication (optional):

LEDs and/or buzzers provide visual and/or audible indication of whether access is accepted or denied.

System Functions:

Security: Only verified RFID tags can open the door.
Ease of Access: Users simply bring the RFID tag closer to the reader to open the door.
Indicators: LEDs and buzzers provide feedback to the user on access status.

How Smart Door Lock Works

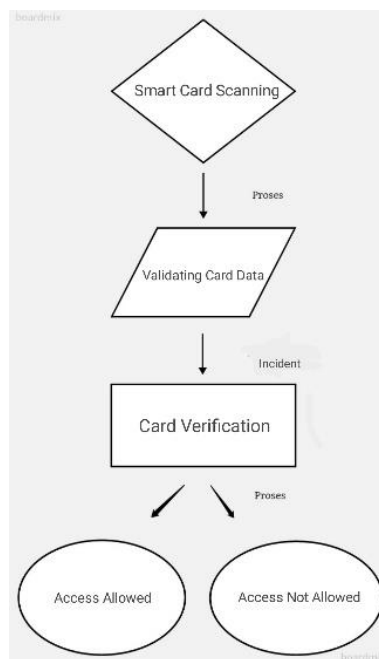


Figure 3. Smart Door Lock Flow Chart

Start Card Scanning:

This step is the beginning of the process where the user inserts the access card or approaches the card scanner. Scanning begins when the access card is connected to the scanner. At this point, the system starts reading the information contained in the access card.

Card Scanner Reads And Verifies ata:

When the card is connected, the card scanner automatically reads the data stored on the card. This reading operation includes retrieving information such as the unique identification number, user data, and access rights. The read data is verified by the system to ensure the authenticity and validity of the information contained in the card. The system performs validation to check if the card has the appropriate permissions for the current request.

Card Verification With System:

The data read from the card is compared and verified with the information stored in the hotel's intelligent door lock system. The system checks the validity of the card. In addition, the system also checks the access rights associated with the card to ensure that the user has permission to access the desired area.

Access Allowed:

If the card is valid and has the appropriate access rights, the door will respond positively. This response unlocks the door and allows access to the locked area. Users can safely enter the area according to their access rights. Each step in this process is important to ensure the security, reliability, and efficient use of your smart door lock system. This way, you can optimize the user experience while maintaining a high level of security in your hotel environment.

Access Not Allowed:

Conversely, if the card is invalid or does not have the appropriate access rights, the system will give a negative response. The door remains locked and access to restricted areas is not allowed. This step is important to maintain security and control access to sensitive or restricted areas in your hotel environment.

Quality Service Evaluation

Reliability: The reliability of the Front One Azana Style Hotel smart door lock system reflects its ability to function over a period of time, for example, on a monthly basis, without significant interruptions or faults. This includes the system's ability to use the card sensor to continuously open the door without causing any significant failures. The reliability evaluation shows how reliable this system is under daily use conditions in the Front One Azana style hotel environment and the expectations of this system to provide reliable entrance services to hotel guests.

Security: Front One Azana Style Hotel Smart Door Lock System security includes the level of protection the system provides against physical attacks and tampering attempts. This includes the system's ability to detect and prevent unauthorized doorthief and vandalism, as well as the ability to protect door access from unauthorized access. The security assessment determines how well the system protects access to hotel doors from security threats that may occur at Front One Azana Style Hotel, ensuring an appropriate level of security for guests inside the hotel instead.

Convenience: Front One Azana Style Hotel User convenience of the hotel's smart door lock system refers to how easy and intuitive the system is for hotel guests to use, This includes easy door card access for Front One Azana Style Hotel, user interface navigation, and the system's response to user commands. The convenience rating helps determine how efficient and smooth the interaction between hotel guests and the smart door system is at the hotel, and helps determine how comfortable users at Front One Azana Style Hotel are improving.

Responsiveness: Front One Azana Style Hotel Smart Door Lock System responsiveness refers to the speed and efficiency of the system in responding to commands from users, such as opening, closing or locking doors, It includes the system's response time to user commands. It refers to how quickly the system can respond to instructions given at Front One Azana Style Hotel. The responsiveness rating can be used to determine how well this system can provide fast and efficient entrance services to hotel guests, optimizing the overall user experience at Front One Azana Style hotel.

Table 1. Smart Door Lock Quality Service Evaluation

No.	Variables	Metrics/Criteria	Measurement Data	Evaluation Results
1	Reliability	Failure Rate	Number of Failures (Per month)	Low
2	Security	Resistance to Physical Attack	Safety Score From (1-10)	High
3	Comfort	User-friendliness	User Survey	Very good
4	Responsiveness	Response Time	Milliseconds	Quick

Network Connection Data Availability of Network Types and Network Performance

Table 2: Network connectivity observations

No.	Room Number	Iot Devices	Connection status	Connection Time	Connection Duration (Minutes)
1	35	Smart Door Lock	Connect	2024-06-17 09:22:12	120
2	72	Smart Door Lock	Disconnected	2024-06-17 11:43:04	30
3	50	Smart Door Lock	Connect	2024-06-17 12:08:34	180
4	87	Smart Door Lock	Connect	2024-06-17 14:55:44	90
5	63	Smart Door Lock	Connect	2024-06-17 16:40:29	150



Observation of network connectivity: Performed by directly observing the IoT system. Monitor the network connection status. Check if your IoT system is connected to your internet network. Observations are made of the following IoT device connectivity status indicators: For example: LED lights or connection icons on the user interface. Notes are made on whether the connection is active, as well as the time and duration of the connection.

Table 3. Network Signal Quality Assessment

No.	Room Number	Iot Devices	Signal Quality	Measurement Time	Measurement Location
1	35	Smart Door Lock	Strong	2024-06-17 09:22:12	Front room door
2	72	Smart Door Lock	Medium	2024-06-17 11:43:04	7th Floor Corridor
3	50	Smart Door Lock	Strong	2024-06-17 12:08:34	Reception area
4	87	Smart Door Lock	Weak	2024-06-17 14:55:44	Main kitchen
5	63	Smart Door Lock	Strong	2024-06-17 16:40:29	Hotel Lobby

Network Signal Quality Assessment: Network signal quality measurement is performed by observing the signal strength received from IoT devices. It evaluates the signal strength and can be classified as strong, medium, or weak. To assess the consistency and stability of the network signal, observations are made at various points around the location of the IoT device.

Table 4. Information on network types

No.	Room Number	Iot Devices	Network Type	Network Name	Frequency	Details Network Configuration
1	35	Smart Door Lock	Wi-fi	HotelWifi	2.4 GHz	WPA2-PSK AES, SSID hidden
2	72	Smart Door Lock	Ethernet	--	--	DHCP
3	50	Smart Door Lock	Wi-fi	LobbyGuestWifi	5 GHz	WPA3-Personal, SSID visible
4	87	Smart Door Lock	Modem	Verzion 4G	LTE	APN:
5	63	Smart Door Lock	Wi-fi	Floor3Wifi	2.4 GHz	WPA2-Enterprise, EAP-TLS

RESULT

The results of this study provide an in-depth description of the implementation and quality of Smart door Lock services based on card sensors at Front One Azana Style hotel. Based on the analysis conducted, several important aspects can be highlighted to strengthen the previously expressed conclusions.

Guest satisfaction

Based on the results of a survey conducted on Front Azana Style Hotel guests, most guests are satisfied with the use of RFID-based smart door locks. The following factors contribute to this satisfaction:

Table 5. Survey

No.	Questionnaire Questions	Room Number	User Answer	Respondent Name/Email	Rating (Scale 1-5)	Time Verification
1	How easy is it to use your access card to open the room?	34	I found the interface very intuitive, making it easy to use.	John Doe / johndoe@gmail.com	5	May 15 2024, 10:30 AM
2	How often do you experience problems opening rooms using access card?	76	Sometimes I need to try several times before the system responds.	Jane Smith / jane.smith@gmail.com	4	May 17 2024, 09:45 AM

3	How do you feel about the speed of the system in opening Key?	88	The system responds very quickly, no need to wait long.	Michael Johnson / michael.icloud.com	5	May 19 2024, 11:15 AM
4	How safe do you feel with using this access card?	32	I feel very safe using this RFID technology.	Sarah Brown / sarahbrown@gmail.com	5	May 21 2024, 02:00 PM
5	How comfortable are you with using this access card?	22	This access card is convenient, although sometimes I forget how to use it.	Emily Davis / emilydavis@icloud.com	4	May 22 2024, 04:30 PM
6	Do you feel the system helps shorten check-in/check-out time? You?	12	This system is very helpful in speeding up the check-in and check-out process.	William Clark / williamclark@gmail.com	5	May 23rd 2024, 08:45 AM
7	How your opinion on	70	My experience very positive, making me	Olivia Martinez / oliviamar@icloud.com	5	May 25th 2024,

From the data collected, it can be seen that the majority of guests are satisfied with various aspects of the use of RFID-based smart door locks at Front Azana Style Hotel. Here are some discussion points based on Figure 3 above:

1. **Ease of Use:** A total of 80% of guests were very satisfied or satisfied with the ease of use of the smart door lock. This shows that the system is intuitive and easy to use for guests from different backgrounds.
2. **Security:** Satisfaction with security is also high, with 80% of guests feeling very satisfied or satisfied. Guests feel more secure due to the difficulty in duplicating RFID cards and the ease in deactivating lost cards.
3. **Privacy:** 80% of guests were very satisfied or satisfied with the privacy provided by the system. More controlled room access provides an added sense of security for guests.
4. **Added Convenience:** 75% of guests were either very satisfied or satisfied with additional conveniences such as access to hotel facilities using the same RFID card. This shows that system integration provides a more holistic experience and makes it easier for guests to enjoy hotel facilities.
5. **System Reliability:** Only 65% of guests were very satisfied or satisfied with the reliability of the system, while 25% were moderately satisfied and 10% were neither satisfied nor dissatisfied. This suggests that there are still some technical issues that need to be addressed.
6. **Check-In/Out Speed:** 80% of guests are either very satisfied or satisfied with the faster speed of the check-in and check-out process thanks to the use of RFID cards. This reduces waiting time and improves operational efficiency.
7. **Handling of Technical Issues:** Only 55% of guests were very satisfied or satisfied with the handling of technical issues. This indicates the need for improvement in the response and handling of technical glitches to increase guest satisfaction.
8. **Staff Training:** 70% of guests were very satisfied or satisfied with the staff's knowledge and skills in handling the RFID system. However, there is still room to improve staff training to ensure better service.

DISCUSSION

Ease of use:

Most customers gave a high rating (5) for ease of use, indicating that the system is intuitive and easy to use. John Doe from Room 34 mentioned that the interface is very intuitive and therefore easy to use. Not having physical keys that can be lost or left behind improves guest comfort, saves time, and reduces potential frustration.

Technical Issues:

Some guests occasionally report technical issues, but overall the system is considered stable. Jane Smith from Room 76 said that it sometimes takes a few tries for the system to respond. Despite minor issues, customer satisfaction remains high, and the hotel should continue to monitor and correct technical errors to ensure the customer experience

remains optimal.

System Speed:

Customers are generally satisfied with the opening speed of the system, which speeds up the check-in and check-out process. Michael Johnson from Room 88 noted that the system responded very quickly without having to wait for a long time. This shows that the RFID technology implemented is sophisticated and effective enough to ensure a smooth user experience.

Security:

Security is one of the most valuable aspects of a guest. Sarah Brown from Room 32 feels very secure using this technology. RFID cards are difficult to copy and easy to deactivate if lost, increasing guests' sense of security and comfort during their stay.

Comfort and flexibility:

Access cards are considered convenient to use and offer enough flexibility. David Lee from Room 87 mentioned that he likes that he can easily customize the approach to his needs. Integration with hotel services such as the gym and swimming pool enhances customer convenience and makes the stay more enjoyable.

Recommendation:

Guests are willing to recommend the use of this pass to a friend or colleague. Daniel Garcia from Room 6 noted that he recommends this pass because of its convenience and security. Positive recommendations from satisfied customers are a strong sign of good service quality and hotel innovation.

Impact on Hotel Operations

The implementation of RFID-based smart door locks at Front Azana Style hotel will also have a positive impact on hotel operations:

- **Work efficiency:** By using RFID systems, hotel staff can manage more efficient access to spaces. The check-in and check-out process is faster, reducing guest waiting time. In addition, hotel staff can easily replace lost or damaged RFID cards without replacing physical keys, saving time and money.
- **Better hotel image:** The use of advanced technology such as RFID-based smart door locks can improve a hotel's image in the eyes of customers and the market. Hotels that use modern technology are often perceived as more advanced and innovative, which can attract more guests and increase occupancy.
- **Data collection:** Using RFID systems, hotels can also collect guest facility usage data. This information can be used to analyze customer preferences and optimize hotel services. For example, hotels can learn which services are used the most and adjust marketing or service development strategies based on this information.

RFID Scanner Operational Logic

Hotel guests receive an RFID card upon check-in. To enter the room, the guest holds the card up to the scanner at the door. The scanner reads the information from the card and verifies it with the hotel's database. If it matches, the door automatically opens. This process is quick and ensures guest safety and convenience.

1. **RFID Card Provisioning:** Upon check-in, hotel guests receive a preprogrammed RFID card for their room.
2. **Card Usage at the Door:** Guest brings the RFID card close to the scanner installed on the room door.
3. **Reading and Verification:**
 - The scanner detects the RFID card and reads the unique data stored on it.
 - This data is directly sent to the hotel control system.
4. **Authentication:**
 - The control system verifies the card data with the guest database.
 - If it matches, the system sends a signal to unlock the door.
5. **Access Granted:** The door is open, allowing guests to enter the room.
6. **Log Storage:** Every access is recorded in the system for security and management purposes. This operation ensures guests can only access rooms they have been assigned, increasing safety and convenience.

Hotel Network Connection Flowchart

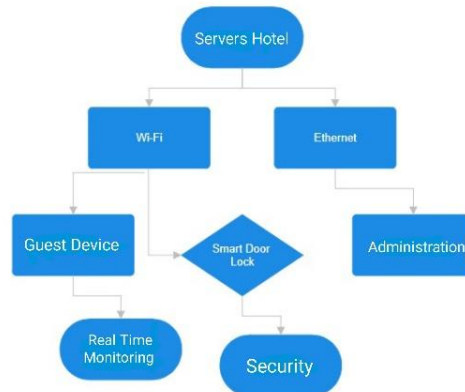


Figure 4. Network Connection Flowchart

Network Availability: The hotel leaves a wide variety of kinship such as Wi-Fi and Ethernet ahead of the retainers and lodging operations.

Type of Network Used:

- Wi-Fi: Used by followers ahead of the internet and by the articulation rules of the gaba ulung ahead of the stringing on the lodge's servers.
- Ethernet: Used in tadbir areas and ahead of faulty devices such as servers.

Network Performance:

- Speed and Stability: network should be beginning and stable ahead of establishing the rules of playful articulation without straining.
- Security: The network should be relieved ahead of keeping the followers' particulars and lodging regulations.

Hotel Implementation:

- Guest Access: Guests utilize the lodge's Wi-Fi ahead of the internet and the lodge's operations which allows for resourceful access to ledge or staffed reservations.
- Smart Lock System: An agile articulation system connects to Wi-Fi ahead of following the RFID ticket keyed information and transfers the instructions to the lodging server ahead of verification.
- Monitoring and Support: Inn staff scrutinize the kinship in real time towards establishing optimal strength. If a problem arises, resourcefulness can rush to address it ahead of fortifying the reservation's splendor.
- Security: Implementation of kinship security announcers such as encryption and firewalls towards keeping the friction between the device and the server. The implementation of reliable kinship at the inn ensures that followers can find the initial internet service and chest relief, imitating the enforcement of the rules of playful articulation of good use, reinforcing the authenticity and solemnity of followers.

CONCLUSION

This research shows that the implementation of an RFID-based smart door lock system connected to the Internet of Things (IoT) at Front One Azana Style Hotel has improved service quality and operational efficiency. RFID and IoT technology improve system reliability, security, guest comfort, and service responsiveness. Other benefits include accelerated check-in and check-out processes and reduced physical key replacement costs. This use of RFID technology allows hotels to optimize resources, increase staff productivity, and provide a more comfortable stay. The integration of RFID-based smart locking systems with IoT also opens up opportunities for innovation in the hospitality industry. Data shows the benefits of these smart technologies, encouraging hospitality businesses to invest in services and operational efficiency. With wider adoption, hotels can offer solutions that are more personalized and responsive to guest needs, providing a competitive edge in an increasingly competitive market.

ACKNOWLEDGMENT

Dear Mommy and Daddy, thank you for all the prayers, support, and love that never stopped during my journey to complete this research. Your support is an invaluable gift to me. You are a source of inspiration and strength in every step of my life. Thank you for always being there, listening, and encouraging me when I need it. Your existence makes this struggle more meaningful and valuable. Last but not least, thank you to my friends in arms who always support and encourage me in every step of this research. You are an inseparable part of this success. Hopefully, all your efforts and sacrifices so far can help me to achieve my goals. I will repay you with happiness and success. I am very grateful to have emak and abah as wholehearted as you, as well as these wonderful friends. With deep love and respect, Fauzan.

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