IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 8, March 2025
Impact Factor: 7.67

AI & Internet of Things: Transforming Smart Home Technology

Sakshi Sanjay Pote and Rani Rajesh Waghmare
S. M. Joshi College Of Arts, Commerce & Science Hadapsar, Pune

Abstract: *Smart homes are revolutionizing our way of life by utilizing the Internet of Things (IoT) and Artificial Intelligence (AI). Homeowners can remotely monitor and control their home environment by connecting IoT devices, such smart lighting controls, security cameras, and thermostats, via a network. AI makes these gadgets more efficient, comfortable, and secure by allowing them to learn from user behavior, make predictions, and automate tasks.*

There are various benefits to smart houses that combine IoT and AI. AI-powered systems can optimize energy use by modifying lighting, heating, and cooling according to occupancy and preferences, which can result in energy savings. Additionally, artificial intelligence (AI)-powered smart security systems may identify possible threats, improving home safety. Smart homes are made even more convenient and appealing by the ability to customize the living space according to user preferences.

The intricacy of device compatibility, security flaws, and data privacy issues continue to be major obstacles in spite of these developments. Building trust in smart home technology requires strong security measures and user data protection, especially as the number of connected devices increases. Furthermore, enhanced communication protocols and standardization are necessary to achieve smooth integration between devices made by various manufacturers.

This paper explores the potential and limitations of AI and IoT integration in modern homes, but there are still issues that need to be resolved as smart homes develop, including data privacy concerns, security risks, and interoperability of devices from different manufacturers...

Keywords: Internet of Things, Artificial Intelligence, Cyber security, Smart home automation, Energy Management.

I. INTRODUCTION

Smart homes are changing our way of life by increasing their intelligence and responsiveness. Homeowners can use applications or virtual assistants to remotely control services like lighting, heating, security, and entertainment in these IoT-enabled residences [1]. A network of interconnected devices known as the Internet of Things collects and shares information, like temperature and occupancy, to improve living conditions in homes. Typical smart home devices include security cameras, locks, lighting controls, and thermostats [2][3].

Artificial Intelligence (AI) makes it possible for computer systems to carry out tasks like problem-solving and decision-making that require human intelligence [4]. In smart homes, AI and IoT collaborate, with AI analyzing data collected by IoT devices to provide predictions and decisions [5][6]. Smart thermostats, which save energy and increase comfort by adjusting temperatures based on user preferences, are one example of how this connection enhances efficiency and convenience [7]. AI also improves security by identifying possible threats using information from cameras and sensors [8]. Furthermore, according on user preferences, AI can customize the smart home experience [9].

Even more sophisticated integrations, such predictive maintenance for household appliances and more user-friendly management systems, are anticipated as AI and IoT technologies develop further. In addition to modifying the surroundings in response to user activity, future smart homes might also predict requirements in real time, including placing supply orders or changing settings according to a homeowner's schedule. The convenience and effectiveness of daily life could be further improved by this development, which may result in homes that are more responsive and self-sustaining.

DOI: 10.48175/IJARSCT-24555

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 8, March 2025
Impact Factor: 7.67

But there are issues including device compatibility, security, and data privacy [10]. Nevertheless, cooperation between AI and IoT is still necessary to build sophisticated, approachable smart houses. In addition to addressing issues like privacy and interoperability, this study examines how IoT and AI are improving household comfort, security, and efficiency. Understanding the capabilities and constraints of these technologies in contemporary houses is the aim.

II. LITERATURE REVIEW

As digital technologies have become more widely used, the combination of IoT and AI in smart homes has become increasingly common in past years. Smart houses are sometimes referred to by a number of different names, such as digital homes, smart living, domotics, intelligent homes, connected homes, and home automation. The research now in publication indicates that during the past ten years, the use of smart home technology has increased dramatically, affecting a number of industries, including healthcare, energy management, and residential settings. Integration systems and the falling cost of smart devices are responsible for the growth of smart homes [11].

For example, the author of [12] proposed that combining AI, IoT, and smart technologies has a significant effect on helping the aged. According to the study, IoT devices produce a lot of data, and AI's strong processing powers enable smart home technology to adjust to the demands of senior citizens, enhancing their quality of life. By allowing seniors to live independently for extended periods of time and postponing the need for institutional care, this can lessen the strain on the healthcare system. IoT and AI integration can also enhance home automation, security, and energy management, providing a complete solution for individuals of all ages.

It's interesting to note that a number of research have concentrated on IoT and AI solutions for senior care in smart homes. For instance, in order to facilitate home-based care for the elderly, the authors of [13] suggested a platform that integrates IoT technology with healthcare services. This platform helps senior citizens live independently at home by providing emergency response services, telemedicine, and remote monitoring. A framework for offering biophilic experiences to senior citizens utilizing smart home services was also put forward in [14] with the goal of improving their general health and wellbeing. Through the use of natural elements and technologies that mimic natural settings, this framework encourages sustainable living practices to assist aging in place while also promoting relaxation and stress reduction.

Researchers in the energy sector highlighted how smart home technologies could lower residential energy usage in [15]. They suggested a scenario based on artificial intelligence that would integrate smart meters, variable electricity rates, and household appliances to improve energy efficiency and lower energy usage. Additional research confirmed these claims, demonstrating that smart home energy management systems provide substantial advantages in a number of areas, such as resources, economics, social welfare, and the environment [16]–[18]. The necessity of strong security measures utilizing smart technologies to safeguard homes and occupants was further emphasized by studies in [19] and [20], which concentrated on smart home security monitoring and danger detection.

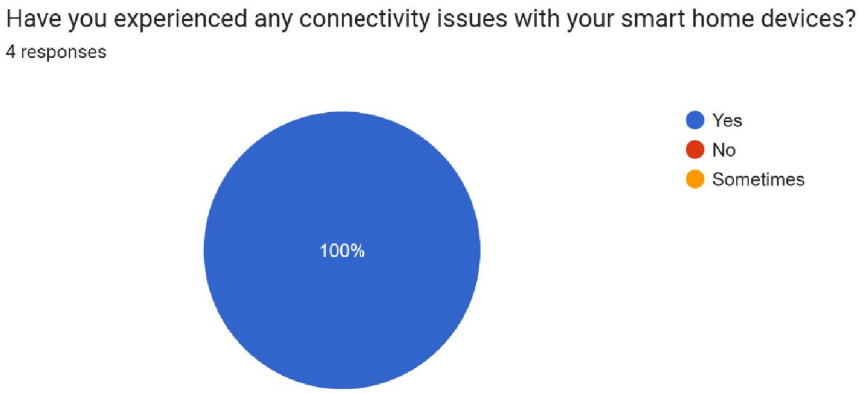
Despite the fact that smart homes are sometimes thought of as expensive, some experts contend that they offer financial advantages linked to better health and environmental sustainability. While smart homes have long-term environmental benefits like decreased carbon emissions and energy consumption, they also have short-term financial benefits like cheaper electricity because of better energy management. There are two main ways that smart houses can accomplish these advantages. First, householders may monitor their energy consumption using smart electric appliances and meters, raising awareness and encouraging energy-saving practices. Second, smart home systems with AI capabilities can optimize and automate energy use, resulting in substantial electricity bill reductions [21]–[23].

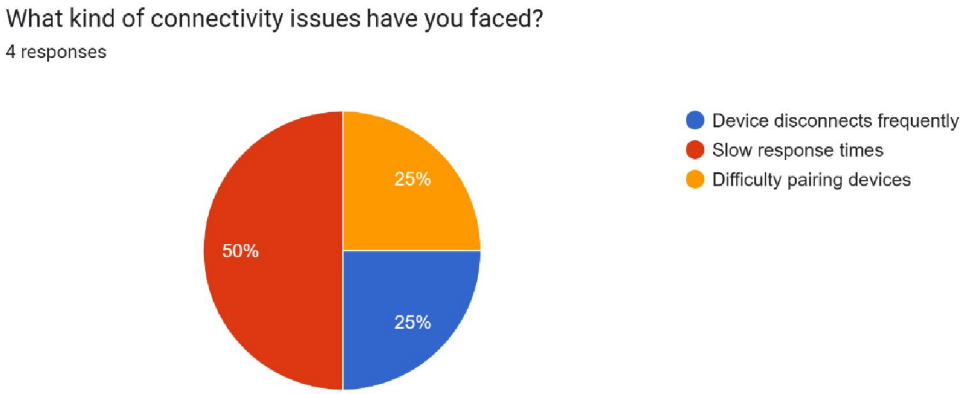
III. DATA COLLECTION

The survey highlights key challenges in connectivity, security, and energy efficiency for smart home users. All respondents reported connectivity issues, including slow response times and frequent disconnections, indicating the need for more reliable networks. Additionally, 75% of users expressed privacy concerns, particularly regarding unauthorized data collection and device surveillance, emphasizing the demand for stronger security measures and transparency. Half of the respondents faced difficulties integrating devices, underscoring the need for better interoperability and standardization in smart home ecosystems.

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 8, March 2025
Impact Factor: 7.67

Battery life issues affected 75% of users, with many favoring energy-efficient or solar-powered solutions. Voice assistants also posed usability challenges, with frequent misinterpretation of commands and slow responses, suggesting the need for improved AI-driven NLP models. Despite these concerns, 75% of users were willing to pay more for enhanced security, energy efficiency, and seamless device integration, demonstrating strong demand for advanced smart home technologies.

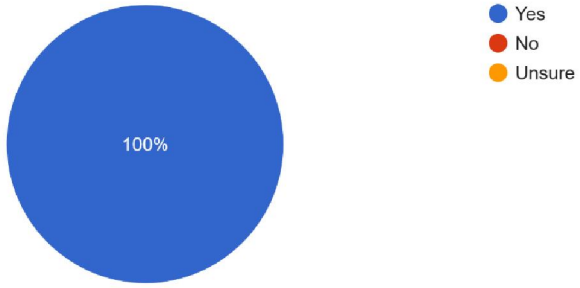




IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 8, March 2025
Impact Factor: 7.67

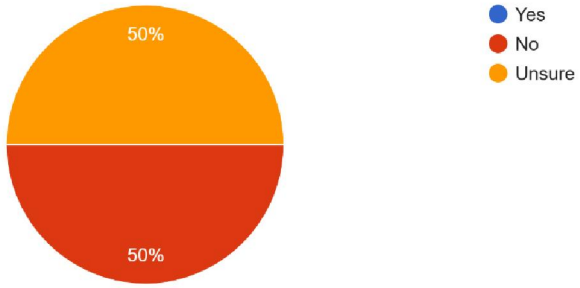
Do you have concerns about the security of your smart home devices?

4 responses



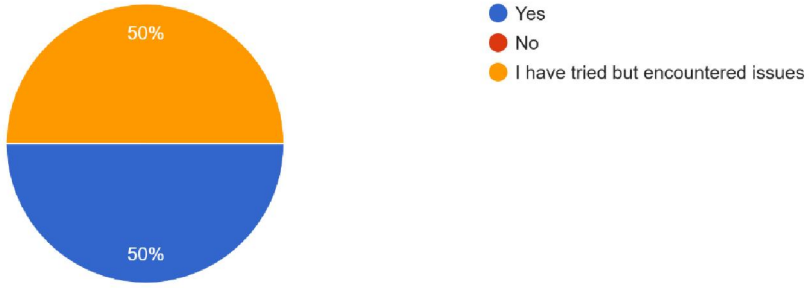
Do you feel your personal data is being handled securely by smart devices?

4 responses



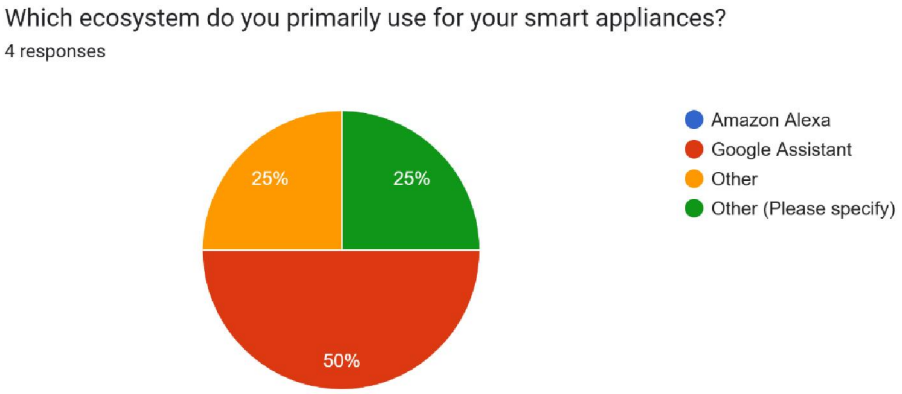
Do you use a central hub or app to control all of your devices?

4 responses



DOI: 10.48175/IJARSCT-24555

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 8, March 2025
Impact Factor: 7.67



IV. FEEDBACK:

1.Feedback Form Link:
https://docs.google.com/forms/d/1LX8vEU34TneHrQlZ1FMRvgPdc-2JV2Gq6k2NQsZIiGE/edit

V. RESULT

While there are many advantages to integrating AI and IoT in smart homes, there are also important concerns including cybersecurity, privacy, interoperability, and system complexity.

Automation driven by AI streamlines daily chores, increasing tenants' convenience and productivity. It makes it possible for security, lighting, and temperature to be automatically adjusted according to user preferences and the surrounding environment. AI optimizes energy use by evaluating data from Internet of Things sensors, which results in notable drops in power consumption and utility expenses. AI-powered smart home security systems can identify and react to threats instantly, giving homeowners more security and peace of mind. Furthermore, AI continuously learns user preferences over time to provide experiences that are customized to fit each person's unique lifestyle.

VI. CONCLUSION

Smart homes that combine AI and IoT have the potential to revolutionize daily life by improving automation, convenience, security, and energy efficiency. However, there are a number of important issues that must be resolved for adoption to be successful. Interoperability problems, cybersecurity threats, and privacy concerns continue to be major roadblocks to smooth deployment. The broad adoption of AI-powered smart home technologies depends on ensuring robust cybersecurity, device interoperability, and data protection.

VII. FUTURE SCOPE OF RESEARCH AND LIMITATION

1. Advanced AI for Predictive Home Automation

AI models can be developed to predict user behaviors in real-time, optimizing smart home automation based on historical data and lifestyle patterns. Adaptive AI can dynamically adjust lighting, temperature, and security based on individual preferences and external factors [24].

2. 5G for Faster Data Processing & Real-Time Control

The integration of 5G technology will enable ultra-fast, low-latency communication between IoT devices, ensuring real-time responses for home automation. AI-driven edge computing will reduce dependency on cloud processing, enhancing data security and [25].

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 8, March 2025
Impact Factor: 7.67

3. AI-Driven Smart Energy Management

AI-powered energy optimization systems can analyze real-time energy consumption and suggest cost-saving measures. Integration with renewable energy sources (solar, wind) to create self-sustaining smart homes [26].

4. Enhanced Cybersecurity for AI-IoT Smart Homes

AI-based intrusion detection and anomaly detection can prevent cyber threats and unauthorized access. Blockchain-based security for IoT devices can ensure data privacy and secure transactions within smart homes [27].

REFERENCES

[1] B. K. Sovacool and D. D. Furszyfer Del Rio, "Smart home technologies in Europe: A critical review of concepts, benefits, risks and policies," Renewable and Sustainable Energy Reviews, vol. 120, p. 109663, Mar. 2020, doi: 10.1016/J.RSER.2019.109663.

[2] A. Natarajan, V. Krishnasamy, and M. Singh, "Occupancydetection and localization strategies for demand modulated appliance control in Internet of Things enabled home energy management system," Renewable and Sustainable Energy Reviews, vol. 167, p. 112731, Oct. 2022, doi: 10.1016/J.RSER.2022.112731.

[3] B. Hammi, S. Zeadally, R. Khatoun, and J. Nebhen, "Survey on smart homes: Vulnerabilities, risks, and countermeasures," Comput Secur, vol. 117, p. 102677, Jun. 2022, doi: 10.1016/J.COSE.2022.102677.

[4] M. S. Alkatheiri, "Artificial intelligence assisted improved human-computer interactions for computer systems," Computers and Electrical Engineering, vol. 101, p. 107950, Jul. 2022, doi: 10.1016/J.COMPELECENG.2022.107950.

[5] O. Hall, M. Ohlsson, and T. Rögnvaldsson, "A review of explainable AI in the satellite data, deep machine learning, and human poverty domain," Patterns, vol. 3, no. 10, p. 100600, Oct. 2022, doi: 10.1016/J.PATTER.2022.100600.

[6] A. P. Singh and P. Tomar, "AI and IoT Capabilities: Standards, Procedures, Applications, and Protocols," Artificial Intelligence to Solve Pervasive Internet of Things Issues, pp. 67–83, Jan. 2021, doi: 10.1016/B978-0-12-818576-6.00004-6.

[7] S. Sharda, M. Singh, and K. Sharma, "Demand side management through load shifting in IoT based HEMS: Overview, challenges and opportunities," Sustain Cities Soc, vol. 65, p. 102517, Feb. 2021, doi: 10.1016/J.SCS.2020.102517.

[8] A. G. Olabi et al., "Application of artificial intelligence for prediction, optimization, and control of thermal energy storage systems," Thermal Science and Engineering Progress, p. 101730, Feb. 2023, doi: 10.1016/J.TSEP.2023.101730.

[9] F. Zhang, Z. Pan, and Y. Lu, "AIoT-enabled smart surveillance for personal data digitalization: Contextual personalization privacy paradox in smart home," Information & Management, vol. 60, no. 2, p. 103736, Mar. 2023, doi: 10.1016/J.IM.2022.103736.

[10] I. Keshta, "AI-driven IoT for smart health care: Security and privacy issues," Inform Med Unlocked, vol. 30, p. 100903, Jan. 2022, doi: 10.1016/J.IMU.2022.100903.

[11] E. Seo, S. Bae, H. Choi, and D. Choi, "Preference and usability of Smart-Home services and items - A Focus on the SmartHome living-lab –," Journal of Asian Architecture and Building Engineering, vol. 20, no. 6, pp. 650–662, Nov. 2021.

[12] P. Carnemolla, "Ageing in place and the internet of things – how smart home technologies, the built environment and caregiving intersect," Visualization in Engineering, vol. 6, no. 1, p. 7, 2018.

[13] D. Choi, H. Choi, and D. Shon, "Future changes to smart home based on AAL healthcare service," Journal of Asian Architecture and Building Engineering, vol. 18, no. 3, pp. 190– 199, May 2019.

[14] E. J. Lee and S. J. Park, "A Framework of Smart-Home Service for Elderly's Biophilic Experience," Sustainability, vol. 12, no. 20. 2020.

[15] A.-G. Paetz, E. Dütschke, and W. Fichtner, "Smart Homes as a Means to Sustainable Energy Consumption: A Study of Consumer Perceptions," J Consum Policy (Dordr), vol. 35, no. 1, pp. 23–41, 2012.

[16] M. Ringel, R. Laidi, and D. Djenouri, "Multiple Benefits through Smart Home Energy Management Solutions—A Simulation-Based Case Study of a Single-Family-House in Algeria and Germany," Energies, vol. 12, no. 8. 2019.

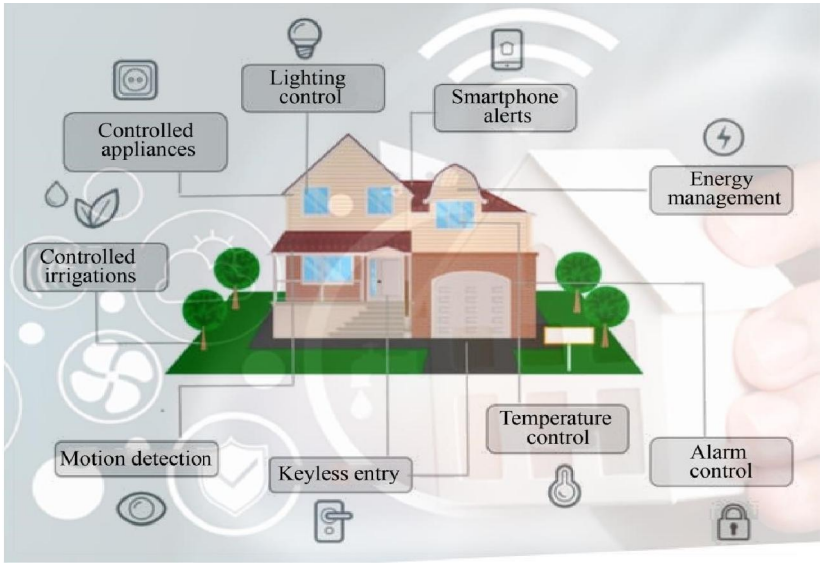
IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 8, March 2025
Impact Factor: 7.67

[17] S. S. Hosseini, K. Agbossou, S. Kelouwani, and A. Cardenas, "Non-intrusive load monitoring through home energy management systems: A comprehensive review," Renewable and Sustainable Energy Reviews, vol. 79, pp. 1266–1274, Nov. 2017.
[18] S. Chen et al., "Butler, Not Servant: A Human-Centric Smart Home Energy Management System," IEEE Communications Magazine, vol. 55, no. 2, pp. 27–33, 2017.
[19] S. Pandya et al., "Smart Home Anti-Theft System: A Novel Approach for Near Real-Time Monitoring and Smart Home Security for Wellness Protocol," Applied System Innovation, vol. 1, no. 4. 2018. doi: 10.3390/asi1040042.*From Smart to Intelligent: How Internet of Things and Artificial Intelligence are Enhancing the Modern Home* 7
[20] J. Dahmen, B. L. Thomas, D. J. Cook, and X. Wang, "Activity Learning as a Foundation for Security Monitoring in Smart Homes," Sensors, vol. 17, no. 4. 2017.
[21] T. Hargreaves, M. Nye, and J. Burgess, "Keeping energy visible? Exploring how householders interact with feedback from smart energy monitors in the longer term," Energy Policy, vol. 52, pp. 126–134, Jan. 2013.
[22] S. J. Darby and E. McKenna, "Social implications of residential demand response in cool temperate climates," Energy Policy, vol. 49, pp. 759–769, Oct. 2012.
[23] N. Balta-Ozkan, R. Davidson, M. Bicket, and L. Whitmarsh, "Social barriers to the adoption of smart homes," Energy Policy, vol. 63, pp. 363–374, Dec. 2013.
[24]Wang, Y., & Patel, R. (2021). AI-Based Adaptive Home Automation Systems. Advances in AI & Smart Living.
[25]Chen, B., et al. (2022). 5G-Enabled AI-IoT Smart Homes. Journal of Wireless Communication & IoT.
[26]Lee, H., & Kim, J. (2023). Renewable Energy Integration in Smart Homes. Sustainable Energy Review.
[27]Singh, A., et al. (2022). Blockchain for IoT Security in Smart Homes. Cybersecurity Journal.

LIST OF FIGURES

Figure 1: AI and IoT Integration in Smart Home Automation

Description of Figure: The flowchart illustrates the process of automating a smart home using IoT devices and AI platforms. It begins with the decision to automate and proceeds to setting up IoT devices. If IoT devices are available, the next step is determining AI compatibility. If compatible, integration with an AI platform enables automation features such as smart thermostats, security cameras, voice assistants, and smart lighting. If AI integration is not possible, users can still implement automation routines like lighting control, security alerts, and temperature adjustments. Ultimately, the system enhances home automation by enabling intelligent, data-driven decisions for security, comfort, and efficiency.



IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 8, March 2025
Impact Factor: 7.67

LIST OF TABLES

Table 1: Comparison of Smart Home Devices with and without AI Integration

Device Type	Without AI Integration	With AI Integration
Smart Thermostat	Manual adjustments required.	Learns user preferences and adjusts temperature automatically.
Smart Security Camera	Provides live feed and basic motion detection.	Analyzes feeds for unusual activity, sends alerts, and differentiates between individuals.
Smart Lights	Basic on/off control via mobile apps.	Automatically adjusts based on occupancy and time of day, learning from user patterns.
Voice Assistant	Responds to basic commands.	Understands natural language, learns user preferences, and offers personalized suggestions.
Smart Locks	Remote locking and unlocking.	Uses facial recognition or proximity to grant access.