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The Role of a Smart Building in Creating a Comfortable Environment for Its Occupants

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Abstract

Today, with the advancement of technology and the increasing problems and busy lives of people, various challenges have emerged in daily life. Addressing each of these challenges leads to greater comfort for humans. The aim of the present research is to investigate the role of smart buildings in creating a comfortable environment for the occupants. In this study, a researcher-made questionnaire was used to collect initial information. The statistical population of this research includes 56 individuals residing in a smart building. Both descriptive and inferential statistical methods were used to analyze the collected data. Descriptive statistics were used to analyze customer information (age, gender, education, etc.). For the descriptive and inferential analysis of the data, SPSS and LISREL software were utilized.

Keyword: the role of smart building, creating a comfortable environment for building residents

Introduction:

Today, with the advancement of technology and the increasing problems and busy lives of people, various challenges have emerged in daily life. Addressing each of these challenges leads to greater comfort for humans. Challenges such as lack of time due to the nature of modern human activities, high energy carrier costs due to the depletion of underground reserves, and increasing social risks pose significant problems for 21st-century life. Since mobile phones were among the first smart technologies of the recent century that addressed a substantial portion of these issues, a new generation of smart systems called smart homes has been developed and introduced to the market. These systems aim to bring a novel experience of technology into our lives, offering greater comfort, safety, and security. The concept of a smart home has taken a serious form with the continuous development of technology in the fields of information technology, computer science, and electronics. To provide a comprehensive definition of a smart home, one can say: "Close communication and interaction for the improvement and optimization of various functions." In essence, it involves connecting all electrical and electronic systems and even other home devices to each other and to a single network that can be controlled and communicated with from a common interface. In simpler terms, a smart home is a modern house where residents can control its equipment integrally, even remotely, through mobile applications, SMS, and more, with just a simple command (Gilbert, 2023).

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Theoretical Foundations:

The concept of a smart home is one of the contemporary ideas that has gained significant popularity both globally and in Iran. Statistics from the website Statista indicate that this industry will have a high turnover, continuous growth, and a large number of users worldwide. Smart homes offer numerous notable advantages, such as increased security and comfort for individuals.

Objective of Home Automation:

By automating your home, villa, or workplace, you not only enhance the architectural and visual quality of your space but also provide greater comfort, safety, and security for yourself and your family through the real-time monitoring and control of home equipment. Considering the rising energy costs in Iran and globally, having a smart building system can lead to energy management and optimization, potentially saving up to 50% of energy consumption (Gilbert, 2023).

The objectives of home automation can be summarized as follows:

- Increased safety, security, and comfort

- Enhancing the luxury of facilities and living environment

- Comprehensive control over all household devices

- Continuous monitoring of all electrical and mechanical equipment in the house

- Precise and easy management and control, even in case of issues

- Intelligent prioritization of usage during emergencies

- Optimization of energy consumption and time, saving up to 50% energy

Features and Benefits of a Complete Smart Home System

With the ongoing advancement of technology and the significant qualitative and quantitative growth of R&D teams in global automation companies, the features and benefits of smart homes are continually increasing to meet the new needs of society and provide comfort, convenience, and peace of mind. Generally, the main features and benefits of a comprehensive smart home system include:

1. Control of All Lighting and Illumination Systems

Imagine being able to control all the lighting systems in your home with a single command. For instance, at night, you can turn off all the unnecessary lights and turn on your bedroom night light with a single tap on an app on your mobile phone. Or during a party, you can light up the chandeliers and spotlights in the living room, adjust the color of the string lights to match your home decor, and even control the brightness. For watching your favorite movie in the TV room, you can set the dimmer lights to a soft glow to create a cinema-like atmosphere. With

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home automation, you can control all lighting equipment, such as chandeliers, spotlights, dimmer lights, and RGB hidden lights, through your mobile phone with a simple command.

2. Control of Heating and Cooling Equipment

During cold winter days or hot summer days, whether you are away from home or planning to go to your villa, you can easily and remotely turn on the heating or cooling equipment to achieve the desired temperature before your arrival, creating a comfortable and pleasant environment. This system is compatible and flexible enough to control any type of heating and cooling technology used in your home, such as split systems, ducted splits, fan coils, radiators, smart fireplaces, underfloor heating, and more.

3. Control of Curtains, Windows, Jacks, and Electric Doors

You no longer need a remote control to enter your home! With a tap on the smart home app, the garage door of your home or workplace starts opening from the end of the street and will be fully open by the time you arrive. Additionally, you can set the windows, awnings, and movable roofs of your villa or home to open automatically based on daylight and optimal weather conditions, creating a refreshing atmosphere for you (Gilbert, 2023).

4. Comprehensive Security and Comfort Systems and Modules:

Security is the most fundamental principle in people's lives. When your living environment is safe, it leads to comfort and well-being. In a smart home, there are modules and equipment designed to ensure the security and safety of its occupants. Equipment such as smart CCTV cameras provide visual and audio surveillance of your surroundings, preventing financial or personal risks. They also serve as an alert and monitoring system for the elderly and children, allowing you to remind them or their caregivers of important tasks like taking medication through two-way audio communication and video (Waldoch, 2021).

Additionally, security equipment like smart alarms, digital locks, smart motion sensors, and smart door and window sensors enhance the safety of your home. These devices allow you to track the entry and exit of individuals and detect any suspicious movement via the smart home app. Comfort scenarios can also be created, utilizing sensors like smart temperature and humidity sensors and smart light sensors, helping you feel more comfortable by synchronizing with the optimal temperature, humidity, and light levels in your home.

5. Safety Sensors and Modules:

A smart home watches over everything! Even if you forget to turn off the water or gas valves before a trip, you can do so easily while traveling. Smart homes are equipped with safety modules that send alerts to your phone and sound an alarm in case of fire, water leakage, or gas leakage while simultaneously shutting off the main water and gas valves.

6. Intercoms and Smart Doorbells:

Sometimes, due to your busy schedule, you might forget to take your house keys with you. Or an unexpected guest or your child might arrive home before you and ring the doorbell. Getting locked out is one of the worst situations! However, a smart home eliminates this concern. With

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smart intercoms and doorbells, you can unlock the door without a key. When someone rings the doorbell, you get notified via the smart home app, see the visitor's image, communicate with them, and unlock the door remotely (Waldoch, 2021).

7. Control of All Audio and Visual Systems:

You no longer need to keep multiple remote controls for devices like the TV, home theater, DVD player, and receiver. A smart home integrates all these controls into a single smart control system, transferring control of all your audio and visual equipment to the smart home app. This allows you to create various scenarios for optimal use of these devices (Norouzi, 2021).

8. Music Control and Playback:

In a smart home, the central smart panel not only controls all smart home equipment but also functions as a unique home theater and music panel. It can create delightful moments by playing your favorite music, and when connected to the TV, you can enjoy powerful HiFi ceiling speakers while watching a movie or football match. With small music panels (audio or music panels) mounted on the walls, you can enjoy stereo HiFi music and define zones to play different music in each room, catering to individual preferences (Waldoch, 2021).

9. Control of Electrical Equipment:

After a long and tiring day at work, you no longer have to wait to make tea or coffee or prepare lunch or dinner upon arriving home. In a smart home, your tea and coffee will be ready when you get home, the jacuzzi will be filled with hot water to relieve your fatigue, and your meal will be cooked in the microwave, ready to enjoy! You can also monitor the electricity consumption of each device on your phone and set scenarios to reduce power usage. You can control the refrigerator, freezer, washing machine, dishwasher, radiator package, aquarium, and more, turning them on or off based on a pre-scheduled timetable.

10. Pool, Sauna, and Jacuzzi Control and Preparation:

By using specific scenarios, you can start your pool, sauna, or jacuzzi remotely, saving time and greatly enhancing the comfort of a smart home. (Norouzi, 2021)

11. Smart Irrigation of Gardens and Green Spaces:

Watering green spaces and gardens requires patience and time. With a smart home, you no longer need to worry about these tasks. Schedule the watering in advance for specific times and days, and let the smart home take care of it, allowing you to enjoy your green spaces without hassle.

12. Voice Command Execution by Smart Voice Assistant:

The variety of user interfaces means you can execute desired operations with a simple voice command to the smart home, even when your mobile phone is not nearby. Smart building systems, in addition to being luxurious and optimizing energy consumption, save time as well. By automating your home, villa, or workplace, you will experience enhanced comfort, security, and up-to-date technology with the latest communication systems available.

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A smart home replaces all separate devices in your home with a central controller that manages everything. This central controller or smart central server, which leads and directs the smart system, offers many features, including controlling lighting and light intensity, controlling heating and cooling systems, controlling audio and visual systems, managing security and safety systems, and overseeing smart irrigation equipment. You can easily control your entire home from anywhere in the world, set predefined scenarios for different parts of the house, and monitor various aspects when you are not at home. A smart home is an intelligent system that, while being controllable, can also adapt significantly to your daily habits.

If you are considering automating your home, villa, or workplace, Caspian Smart Home Company offers the best products and services in smart building systems, bringing you comfort, convenience, and security intelligently (Gilbert, 2023).

Types of Smart Buildings:

Smart buildings can be categorized based on their usage or the components used in them. Some types of smart buildings include:

1. Residential Smart Buildings

These buildings, also known as smart homes, are designed to enhance the comfort and security of residents. They feature equipment such as temperature and light control systems, smart home alarms, CCTV cameras, audio and visual systems, and other smart devices (Norouzi, 2021).

2. Commercial Smart Buildings

These buildings are designed for commercial and office use, including shopping centers, smart hotels, banks, company offices, and other commercial places. They also use various smart equipment such as temperature and humidity control systems, lighting systems, surveillance and access control systems, and other smart devices.

3. Industrial Smart Buildings

These smart buildings are used for industrial applications, warehousing (smart warehouses), agriculture, and more. They feature equipment such as automated temperature control systems, security and safety monitoring and control systems, and other smart devices (Gilbert, 2023).

Research Methodology

Curiosity and research are natural human traits. The desire to understand and satisfy this curiosity has led to countless discoveries. Scientific principles and laws are the result of valuable research conducted by scientists (Hosseini Nasab, 2003: 60). John Dewey describes research as a systematic search process to determine a situation. Therefore, research is a process through which one can search for the unknown and gain the necessary knowledge about it. This process is referred to as "methodology," which involves gathering evidence and transforming it into findings. The scientific method or scientific research method is a systematic search process to determine an uncertain situation. In this chapter, we first discuss the research method used in this study, followed by the research process, statistical population, sample size, data

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collection tools, validity and reliability of the tools, data collection method, and data analysis method.

Statistical Population

A sample representing the population is called a sample. The higher the ratio of the sample to the whole, the better the sample can describe the characteristics of the target population, thus having higher scientific validity (Best, Persian translation, 2002: 54). The statistical population of this research includes 56 residents of a smart building.

Sampling Method and Sample Size

In this study, considering the small size of the statistical population, a census method is used, and a questionnaire is distributed to all 56 residents.

Data Collection Method

For any research, two types of data can be used: primary data and secondary data.

Secondary Data

In this research, to study the theoretical topics related to the research subject and to review the literature and research background, written information including specialized marketing books, the internet, marketing journals and articles, similar dissertations, and other related books, brochures, and catalogs have been used.

Primary Data

In this research, a researcher-made questionnaire has been used to collect primary data, which is distributed among the residents of the smart building.

Data Analysis Method

Both descriptive and inferential statistical methods have been used to analyze the collected data. Descriptive statistics are used to analyze customer information (age, gender, education, etc.). For the descriptive and inferential analysis of this research data, SPSS and LISREL software have been used. To test the hypotheses, structural equation modeling (path analysis) and regression analysis will be used, and the Friedman test will be used to rank the variables.

Structural Equation Modeling

Structural equation modeling (SEM) and the LISREL software, one of the most renowned software for implementing such models, have been used to test the hypotheses to assess the simultaneous, direct, or indirect relationships between variables. One of the most powerful and suitable methods for analysis in behavioral and social sciences research is multivariate analysis, as the nature of these subjects is multivariate and cannot be solved using bivariate methods (where each time only one independent variable is considered with one dependent variable).

Multivariate analysis refers to a series of analytical methods whose main feature is the simultaneous analysis of k independent variables and n dependent variables. Structural

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equation modeling is one of the main methods for analyzing complex data structures and shows the simultaneous effects of variables on each other in a theory-based structure. This method combines complex mathematical and statistical analyses from factor analysis, multivariate regression, and path analysis into a complex system to analyze complex phenomena. Through this approach, the acceptability of theoretical models in specific populations can be tested using correlation, non-experimental, and experimental data. Structural equation modeling is divided into two main phases: confirmatory factor analysis and path analysis. In the measurement part, the relationship between indicators or questionnaire items and constructs is examined, and in the structural part, the relationship between the examined factors with each other is considered to test hypotheses (Kalantari, 2009).

Confirmatory Factor Analysis

In confirmatory factor analyses, where the researcher's goal is to confirm a specific factor structure, hypotheses about the number of factors are explicitly stated. In confirmatory factor analysis, the researcher seeks to develop a model that is assumed to describe, explain, or justify empirical data based on a relatively small number of parameters. This model is based on pre-experimental information about the data structure, which can be in the form of:

1. A theory or hypothesis

2. A specific classification scheme for items in accordance with objective shape and content features

3. Known experimental conditions

4. Knowledge from previous studies about extensive data.

The important distinction between exploratory and confirmatory analysis methods is that the exploratory method identifies the most economical way to explain the underlying common variance of a correlation matrix, while confirmatory methods (hypothesis testing) determine whether the data fit a specific factor structure mentioned in the hypothesis. Lisrel software is used for confirmatory factor analysis. This software, designed by the international scientific software company (SSI), estimates and tests structural equation models. This software, using correlation and covariance between measured variables, can estimate or infer factor loadings, variances, and errors of latent variables (Sarmad et al., 1997).

Model Fit Tests

Although various types of tests, generally referred to as fit indices, are continuously compared, developed, and refined, there is still no consensus on even one optimal test. As a result, different articles have provided different indices, and even well-known SEM programs like Lisrel and Amos offer numerous fit indices (Hooman, 2005).

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Some of these indices include:

1. GFI Index

: The GFI index evaluates the relative amount of variances and covariances jointly through the model. The GFI range is between 0 and 1. The GFI value should be equal to or greater than 0.8 for the model to be accepted (Hooman, 2011).

2. AGFI Index

: Another fit index is the AGFI, which is the adjusted GFI value for degrees of freedom. The value of this index also ranges between 0 and 1. The GFI and AGFI indices proposed by Joreskog and Sorbom (1989) do not depend on sample size (Hooman, 2011).

3. RMSEA Index

: This index, the root mean square error of approximation, should be as close to zero as possible (ibid, 2011).

4. Chi-Square (χ^2)

: The chi-square test examines the hypothesis that the proposed model matches the observed covariance matrix. The chi-square value is highly dependent on sample size, and large samples can inflate the chi-square value more than what can be attributed to model inaccuracy (ibid, 2011).

5. NFI and CFI Indices

: The NFI index, called the Bentler-Bonett index, is acceptable and indicates model fit for values above 0.9. The CFI index, which is acceptable and indicates model fit for values above 0.9, compares the proposed model with an independent model where there is no relationship between variables. The CFI index is similar to the NFI but penalizes for sample size (ibid, 2011).

In confirmatory analysis using Lisrel software, there are a series of conventional indices that, if their values are within an acceptable range, make the model execution significant and the proposed path appropriate. Confirmatory factor analysis is used to examine the validity of the scale used. As mentioned, first, the adaptability of the model needs to be tested. Existing literature suggests that for a good model fit:

- The chi-square divided by the degrees of freedom (χ^2/df) should be less than 3.

- The GFI should be greater than 0.8.

- The AGFI, NFI, and CFI indices should be greater than 0.9.

- The RMSEA should be less than 0.1 (Henry and Stone, 1994).

Lisrel software calculates a t-value for each free parameter (estimated) in the model. This test shows which parameters can be removed from the model without significantly increasing the

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chi-square value. Ideally, these values should be less than 1.96 to be considered insignificant (ibid, 2011).

A minor fit measure, the multiple correlation squared (R^2), is obtained for each equation and for the measured variables in a complete structural equation model. The R^2, which represents the proportion of variance explained by the latent variable, should be as close to 1 as possible (ibid, 2011).

Research Findings

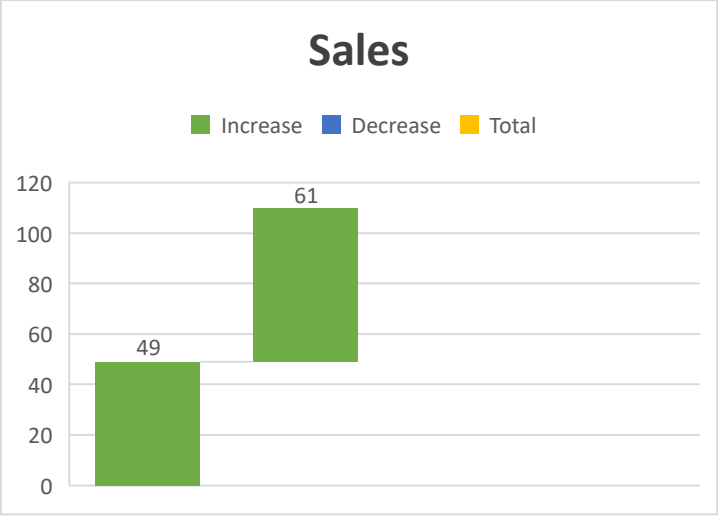
Summary

Reference

- **Gender**

Table 1: Participants' Status by Gender

Gender	Frequency	Percentage
Male	33	61.7%
Female	27	49.3%
Total	60	100%



Age

Table 2: Participants' Status by Age

Age	Frequency	Percentage
15-20	10	13.3%
21-29	35	66.7%
30 and above	15	20%
Total	60	100%

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Figure 4-2: Bar Chart of Participants' Distribution by Age Variable

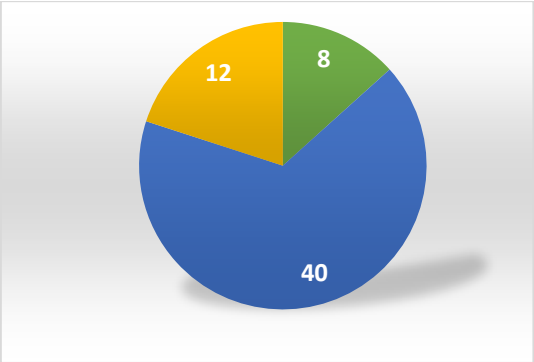

Table 3: Descriptive Statistics of Participants' Scores on Research Variables

Component	Mean	Standard Deviation	Variance	Minimum Score	Maximum Score
Smart Building	81.43	6. 77	45.87	69	98
Non-Smart Building	11.46	5. 97	35.71	5	27
Sense of Calmness	12.63	5. 16	26.71	5	30

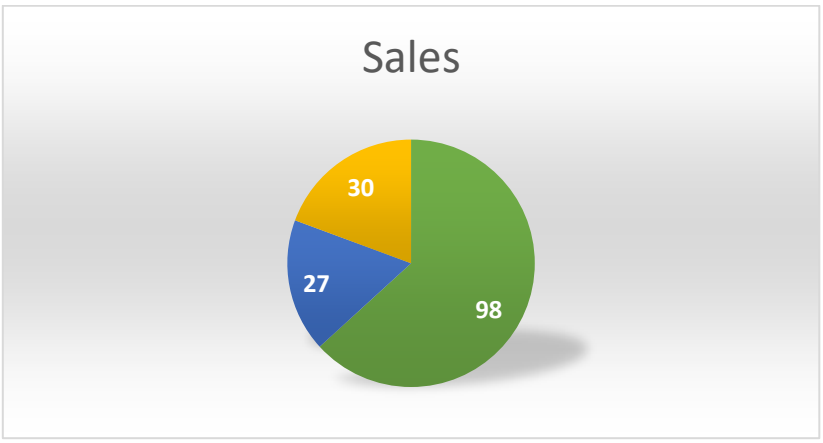

Table 4: Distribution Statistics of Research Variables

Component	Skewness	Kurtosis	Kolmogorov-Smirnov	Significance level
Smart building	0.33	0.18	0.06	0.20
Non-smart building	1.04	0.09	0.22	0.00
Creating Security and calmness	0.94	0.97	0.14	0.00

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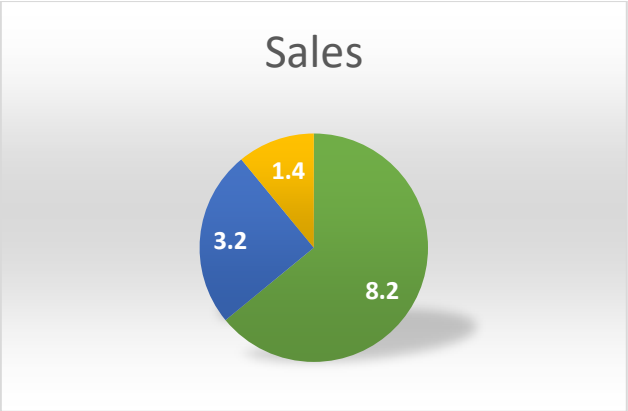

Summary and Conclusion

Today, with the advancement of Artificial Intelligence (AI) and the Internet of Things (IoT), smart homes have become a reality, allowing remote control and management of various household devices and systems. However, these advancements have also heightened security concerns. Protecting data, preventing cyber attacks, and safeguarding users' personal information are among the key advantages of AIoT in the realm of smart homes.

The history of AIoT dates back to the early years of both technologies. AI emerged in the 1950s with concepts such as neural networks and machine learning algorithms and has made significant progress up to the present day. IoT began in the 1990s with the interconnection of devices and objects to the internet and the exchange of data. The combination of these two technologies, known as AIoT, has been recognized as a growing trend in the technology sector in recent years.

Given the complexity and high number of devices and systems connected to the network in a smart home, the need for security and information protection is more critical than ever. Effective measures to prevent cyber attacks, detect and prevent threats, and protect users' sensitive data are of paramount importance. By utilizing AI algorithms to detect unusual patterns, encrypt data, use secure networks, and continuously update smart home software and devices, significant improvements in the security of AIoT-enabled smart homes can be achieved. Consequently, focusing on security in the design, deployment, and use of AIoT smart homes is essential to prevent cyber threats and privacy breaches.

With AIoT, many past threats are eliminated, and human life becomes safer. Although this combination of artificial intelligence and the Internet of Things has not yet been widely adopted in Iran, it is estimated that the number of active IoT devices worldwide will increase from 8.74 billion in 2020 to over 25.4 billion by 2030. AIoT offers an excellent solution for tracking these devices and evolving technologies for the future.

Given the novelty of the topic, a comprehensive examination of all challenges is difficult. However, this article attempts to explain various dimensions of the subject. AIoT is based on three key emerging technologies, as shown in Figure 1:

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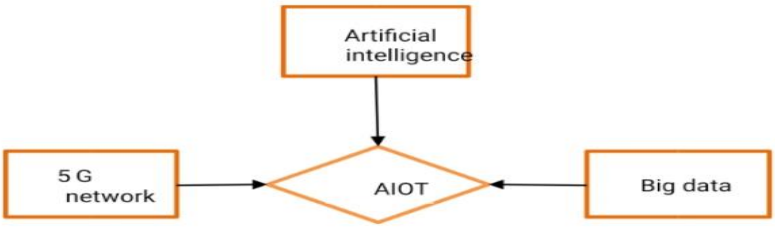
1. Artificial Intelligence: Programmable functions and systems that allow IoT devices to learn and process information like humans.

2. 5G Networks: The fifth-generation network refers to a wireless communication technology that provides high speed, bandwidth, and connectivity for mobile communications. This new generation of telecommunication networks enables advanced services such as the Internet of Things, augmented reality, smart vehicles, and electronic health. With increased speed and stability, 5G serves as the main infrastructure for developing future technologies.

3. Big Data: A collection of extremely large, complex, and diverse data sets generated at high speed that requires powerful data processing technologies for analysis, extracting useful information, and creating meaningful patterns and connections. These data are usually gathered from various sources like IoT sensors, social media, online data, and different systems, aiding strategic and efficient decision-making in organizations.



The best solution for managing the flow and storage of big data in an IoT network is to collect and process data locally at an AIoT node. This not only reduces communication burden and processing delay but also enhances service quality and data privacy. AIoT is transformative for both technologies and mutually beneficial, as AI adds significant value through materials and software. This integration impacts the Industry 4.0 revolution, influencing maintenance, production chains, optimization, and logistics in industries to achieve increased productivity and profitability. The true intelligence of an IoT service is determined by the level of processing or functionality it can perform. A non-smart IoT system will have limited capabilities and will not be able to evolve with data.

The Internet of Things (IoT) refers to billions of physical devices around the world that are connected to the internet, collecting and sharing information with users and other connected devices. Flexibility and the ability to learn and adapt to new and complex inputs are main features of a smart system. This capability allows machines to automatically and optimally respond to changes in the environment and new inputs. Such flexibility can be used in various fields like robotics, smart vehicles, and smart home systems, improving the performance and efficiency of these systems. The fact that robots need to learn and grow naturally is crucial for them to interact effectively with our complex and changing environment. Thus, flexibility and the ability to learn and adapt are vital aspects in designing and implementing smart systems that can significantly enhance their performance and efficiency.

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Artificial Intelligence (AI) refers to the simulation of human intelligence by machines and computer systems. AI has the potential to change how humans live, work, and play. This technology performs better than humans in many fields, especially repetitive tasks, and is currently used in various industries. AI can integrate sensory data from different devices with AI capabilities, enabling organizations to improve their processes and make better decisions.

AIoT: Advantages and Challenges

1. Enhanced Security:

IoT devices can be vulnerable to security risks. However, AI can identify and prevent these risks, as AI algorithms can analyze sensor data to detect anomalies and potential security breaches. For example, AI can analyze security camera footage to identify suspicious activities and alert security personnel.

2. Reduction in Human Error in Businesses:

Millions of dollars are lost annually due to human error. By integrating machine learning with IoT technology, organizations can effectively reduce errors. In regular workflows, data must pass through multiple phases or locations, creating more opportunities for human errors such as data entry mistakes. AIoT reduces these risks by analyzing information at its source. Minimizing data movement and reducing the number of intermediaries involved significantly lowers the chance of errors.

3. Personalization:

While IoT devices can collect information about user preferences and behavior, AI can use this information to further tailor user experiences. For instance, a smart speaker can use AI to learn a user's music preferences and automatically generate custom playlists.

Despite its benefits and applications, there are scenarios where AIoT might fail, leading to production backups or other negative consequences. For example, malfunctioning delivery robots might cause delays in product delivery. Smart retail stores might fail to read a customer's face correctly, resulting in the accidental theft of a product by a customer. Similarly, a self-driving vehicle might fail to recognize its surroundings, such as an upcoming stop sign, leading to an accident.

smart House

A smart home refers to a residence equipped with a communication network, home devices with advanced technology, home appliances and sensors that can be accessed remotely. The Internet of Things played a vital role in the emergence of the concept of smart home technology. This concept refers to devices and household appliances connected to a common network. Its purpose was to make people's lives easier and to make devices more accessible for control. With artificial intelligence, machines learn instructions and make decisions based on previous actions. These smart homes help to maintain the safety of working or resident people, as well as detect the presence of a person and manage the temperature based on that. Smart devices learn through human interaction and reaction. AIoT tools can also store and

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learn from user data to understand user habits to provide customized support. By including intelligent monitoring in the digitization of personal data, the data can be analyzed effectively.

Smart home security

Smart home security consists of several aspects that should be taken into account. Below are some aspects of smart home security :

1-Physical security: This includes the use of CCTV cameras, motion sensors, smart locks, and fire and burglar alarm systems. These devices allow users to monitor the status of their home live and take necessary measures in case of unwanted incidents .

2- Network security: Establishing secure communication between smart home devices, cloud servers and user devices is one of the important issues in network security. Using encryption protocols, firewalls and intrusion detection systems can help maintain network security .

3-Access management: Accurate determination of user access to smart home devices and definition of different levels of access for each user are effective ways to prevent unauthorized access to data .

4-Data encryption: using data encryption protects users' sensitive information from unauthorized access .

5- Updating the software: keeping the software of smart home devices up to date plays an important role in order to improve the security of the system .

6- Use of two-factor identification technology: Using two-factor identification technologies, such as fingerprint identification or two-step identity verification, strengthens the possibility of verifying the identity of users .

Considering these aspects, the appropriate combination of these methods and technologies can help to maintain the security of the smart home

AIoT plays an important role in the development of smart homes. Internet of Things sensors embedded in the home can collect data related to temperature, humidity, lighting, energy consumption, and more. Artificial intelligence algorithms can analyze these data to optimize the heating and cooling system, reduce energy consumption, improve efficiency and increase home comfort and security.

1- Artificial intelligence can use the data of all your connected devices to learn the lifestyle habits of each family member. When it detects that you are in your room, it automatically adjusts the lighting, temperature, music and window curtains according to your preferences. When you leave the room, everything in your room turns off .

2 -Users can remotely allow other people to enter easily through mobile phones. And the recorded video is not just about safety, but also for entertainment purposes like watching your pets perform live .

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3 -Artificial intelligence can learn and imagine the needs of a user. For example, a smart kitchen can be set up before the user even returns home to start cooking .

Previously, the scope of home automation research was limited to remote control systems or systems based on voice commands or systems based on virtual assistant. The problem with these systems was that they were not self-adjusting systems, and they were not mood-enhancing systems based on emotions. This proposed system is very interesting and innovative. By combining real world data with emotions and sensing, this system can improve the user experience and increase the security and efficiency of the smart home. Also, the use of neural network and artificial intelligence algorithms to detect emotions and control ambient light based on the user's mood, turns this system into a leading project in the field of home automation.

The possibilities for home automation are endless. With the integration of artificial intelligence and the Internet of Things, smart homes not only respond to technologically savvy people, but also greatly help in saving energy costs and higher security. Therefore, smart homes bring ease of satisfaction and sense of security for the next level of life with high technology. Internet of things and artificial intelligence are working wonders in smart home automation for the better

According to the above, using AIoT technology for smart home security can significantly improve detection, prevention and response to security threats .

Smart home security with AIOT

Artificial intelligence can be the key to unlocking the full potential of Internet of Things devices and improving security in the IoT industry. Using past data, artificial intelligence can predict future activities and make smarter, data-based decisions. By increasing connectivity and data exchange, the Internet of Things adds value to artificial intelligence technology. Considering the security gap in AIoT devices, the security of personal and corporate data with these devices must be guaranteed. The growth of AIoT paves the way for more efficient, secure and reliable systems for companies and consumers .

Smart home before and after the presence of AIoT

Features based on AIoT are available for the smart home that were not available before .

.1 Detection and prevention of threats :

AIoT: AIoT systems can detect normal and abnormal patterns by using artificial intelligence algorithms and automatically deal with security threats. For example, if the AIoT system detects that an unauthorized person has entered the house, it can automatically take necessary actions .

- Traditional methods: On the contrary, traditional systems require manual intervention to detect and prevent threats. This means that there is a need for the presence of a human person to make decisions and take necessary actions.

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2 .Response to immediate events :

- AIoT AIoT systems can automatically and immediately respond to security events and take necessary measures. For example, if an unusual movement is detected at home, the AIoT system can automatically activate security plans and respond immediately .

- Traditional methods: In traditional methods, there is a need for manual intervention to respond to security incidents. This may take time and cause delays in responding to threats .

3 -More accurate diagnosis :

AIoT: Using artificial intelligence technology, AIoT systems can detect threats more accurately and reduce errors. For example, the AIoT system may distinguish between active movements in the home and operate based on automatic algorithms .

Traditional methods: On the other hand, traditional systems may suffer from errors and cannot accurately detect threats. This may lead to misinformation and inappropriate response to threats .

AIoT security solutions not only save manpower, but are also better for human work in many ways. For example, security cameras have sharper eyes than security guards when connected to a database. Every day, a huge amount of visual information is collected by high-quality cameras and converted into structured data through advanced artificial intelligence algorithms that can be calculated and compared In this way, AIoT makes it possible for cameras to not only record what a person is doing, but to immediately recognize who that person is. In addition to the convenience and efficiency of cross-checking afterwards, the AIoT security system can also deal with emergency situations in time or even before they occur. In short, through pattern analysis, it expands protection to prevention .

Since the cameras are connected to other devices in AIoT such as alarm and access control, the security system actually has the power to take actions according to the collected and analyzed information. Like air conditioners and humidifiers, they take care of these situations. While security may still be a top priority for family users, it won't be the only value. The smart home solution allows cameras to do more than just monitoring when they are connected to other parts of the home such as locks and phones through AIoT. Users can remotely allow other people to log in easily through mobile phones.

In a typical smart home system, there is a gateway that connects lights, locks, thermostats, sensors, etc. These devices are controlled remotely or automation routines are set manually. When you add artificial intelligence to this smart home system, you are essentially adding a brain that learns your habits and preferences and acts on your behalf to control these devices for your benefit

It uses connected cameras and facial recognition technology to identify family members from unwanted visitors. When a family member comes home, the artificial intelligence can automatically deactivate the security mode and open the door for that family member. On the other hand, if it detects unwanted visitors, the artificial intelligence sounds the alarm and immediately warns the family and relevant authorities .

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In an AIoT system, artificial intelligence can use various connected devices to keep the family safe. For example, AI can use cameras to detect a child approaching a pool or an elderly person falling and alert you to these activities. A gas sensor can be used to detect gas leaks and automatically turn off the gas stove .

its advantage

Real-time processing: Processes data calculations in real time even in remote locations with limited or no internet connection .

• Privacy: Stores data calculations in your home. You don't have to worry about being hacked when transferring your data to the cloud or leaking your private information from a cloud server .

Cost: With AIoT, there will be a significant reduction in bandwidth and cloud storage costs .

Results and future work

From the researches and investigations, it is clear that with the combination of artificial intelligence technology and Internet of Things (AIoT), many changes will occur in the security of the smart home, including allocation and prevention of threats, response to immediate events and more accurate diagnosis will have better performance. This combination can not only allow smart home devices and systems to collect and process information, it can also include methods of identifying unusual patterns by artificial intelligence algorithms, data encryption, using secure networks, updating software and smart home devices, developing intelligence models. Use artificial intelligence to predict and prevent security incidents. Therefore, it is necessary to focus on security in the design and deployment of smart homes using AIoT technology to prevent cyber threats and privacy violations. These innovative canvases can not only lead to increasing the security of the smart home, but can also lead to improving the efficiency and making these systems more useful. Due to the growth of technological advances, the use of AIoT in smart homes is expected to increase.

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