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Presenting the Internet of Things (IoT) Technology Framework for Realizing Urban Smart Housing (Case Study: District 6 of Tehran)

[1]Somayeh Teymouri, [2*] Salman Moradi
[1]Ph.D. Graduate in Urban Planning, Kharazmi University; Lecturer, Department of Urban Planning, ST.C., Islamic Azad University, Tehran, Iran.
[2*]Assistant professor, Department of Urban Planning, ST.C., Islamic Azad University, Tehran, Iran.

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ABSTRACT: The role of smart technologies, particularly the Internet of Things (IoT), has been recognized as a promising tool in achieving urban sustainable development goals and advancing toward smart cities. The present study aims to investigate the role of IoT technology in realizing urban smart housing in District 6 of Tehran. The research employs a descriptive-analytical method, examining indicators of IoT technology and smart housing. First, the dimensions and components of the research were identified, and the results were analyzed using statistical tests. The collected data were analyzed using Amos software, and the final research model was developed. The findings indicate that achieving an urban economy is the primary requirement for smart housing in District 6, followed by the adoption of a smart lifestyle. Interviews with experts and urban managers revealed that current policies for implementing urban smart housing are not in a favorable state, and policy changes are necessary to move toward Smartization. Therefore, there is a consensus between citizens and urban managers regarding the state of policies, suggesting that urban management should strive to improve the level and quality of life for residents, based on their demands and the existing indicators in District 6 of Tehran, by implementing the principles and components of smart housing.

Keywords: *Internet of Things (IoT), Smart City, Smart Housing, District 6 of Tehran.*

INTRODUCTION

The rapid pace of urbanization and population growth in metropolises has created numerous challenges in resource management, energy consumption, and urban quality of life. Central and densely populated areas of metropolises, in particular, face issues such as outdated building structures, inefficient energy use, heavy traffic, and environmental pollution (Sekher & Govil, 2022). These problems not only negatively impact residents' well-being but also entail significant economic and environmental costs. The primary causes of these challenges can be traced to the lack of integrated urban management systems, inadequate smart infrastructure, and resistance to technological innovations (Akande et al., 2019). Meanwhile, the rapid expansion of cities outpaces the capacity to develop their infrastructure, placing increasing pressure on urban systems (Pour Ahmad et al., 2018). Smart housing is considered one of the most critical challenges in contemporary cities. With the growing urban population and diminishing green spaces, residents face numerous issues, including insufficient space for housing construction and inadequate infrastructure to provide services to residents (Hosseinpour & Houdseni, 2024). One of the key technologies for achieving smart housing is the Internet of Things (IoT). This technology, through connectivity between objects and related systems, offers opportunities to improve the environmental and structural conditions of housing. By utilizing sensors and smart devices, precise data on housing environmental conditions, energy consumption, air quality, and other living conditions can be collected and analyzed to provide residents with accurate information (Kamal Nejad, 2024). The Internet of Things represents a novel perspective in the information technology industry, encompassing technical, economic, and social dimensions (Yadegari et al., 2023). IoT has emerged as a key solution for transforming smart cities into intelligent and sustainable systems. These technologies, by connecting devices, sensors, and management systems, enable real-time monitoring, energy consumption optimization, and enhanced urban services (Alavi et al., 2020). For instance, studies indicate that IoT-based smart systems can reduce building energy consumption by up to 40% (Khan et al., 2022). Addressing this issue is significant from both socio-economic and environmental perspectives. First, smart urban housing can

*Corresponding Author Email: salmanmoradi@iau.ac.ir ORCID: 0000-0003-0443-5258

create economic value for residents and urban management by reducing operational costs and increasing efficiency (Kim et al., 2025). Second, improving air quality and reducing greenhouse gas emissions through smart monitoring systems contributes to achieving sustainable development goals (Sharifi & Murayama, 2015).

Among the urban areas of the Tehran metropolis, District 6 stands out due to its combination of old residential structures and bustling commercial centers, making it a key case for examining the challenges and opportunities of implementing IoT at a local scale. Recent studies suggest that focusing on localized solutions and engaging local stakeholders ensures the success of smartization projects (Ivanov et al., 2025). Therefore, exploring the application of IoT in this district not only helps address current issues but can also serve as a model for other urban areas in Iran. Given the strategic importance of this district, the present study aims to propose an IoT technology framework for realizing smart housing to enhance the well-being and comfort of residents. Accordingly, the main research questions are formulated as follows:

- What are the main dimensions and components of smart housing with an emphasis on IoT technology?
- What is the proposed framework for smart housing with an emphasis on IoT technology?
- What solutions are recommended to achieve smart housing with an emphasis on IoT technology?

Theoretical Framework and Literature Review

The concept of "urban smart housing" and the application of Internet of Things (IoT) technologies in its implementation have rapidly evolved in recent years as both a research and practical domain, rooted in the convergence of technological advancements and the growing needs of urbanization (Lee &Yoon, 2023). Understanding the background of this topic requires examining the historical evolution of its key components—"smart housing," "smart city," and "Internet of Things" and subsequently, how these concepts have been integrated and synergized (Mohammadi et al., 2022). The emergence and maturation of IoT technology mark a turning point in the history of smart housing. The widespread connectivity of objects and household devices to the internet has enabled the collection of vast amounts of environmental and behavioral data, paving the way for intelligent data analysis and the provision of value-added services to residents (Morabito, 2010). Since the 2020s, smart housing has transcended its role as an independent residential unit, becoming an integral part of the smart city ecosystem (Castellani et al., 2024). In recent years, the "smart citizen" approach has emerged as the dominant paradigm in smart city development (Mora et al., 2017). The concept of the "Internet of Things" (IoT), first introduced by Kevin Ashton in 1999, initially focused on object identification and tracking through RFID technologies (Ashton, 2009). Over time, however, the scope and depth of this concept have significantly expanded, establishing IoT as a foundational infrastructure for pervasive smartization across various domains, including cities and housing (Weber & Weber, 2010). The 2020s have emphasized integration, sustainability, and citizen-centricity. During this period, urban smart housing is regarded not only as an intelligent residential unit but also as a fundamental building block of the smart city ecosystem (Edwards et al., 2021). Integration with smart energy grids, intelligent transportation systems, and smart urban services, along with a focus on sustainability, efficient resource consumption, and special attention to citizens' needs and participation, are key features of this new approach (Novak et al., 2021).

Ullah et al. (2025), in a study titled "Smart Homes and Buildings with Sixth-Generation Internet of Things: Enabling Technologies, Opportunities, and Challenges," conducted a comprehensive review of emerging technologies, particularly those less explored in the context of smart homes (SH) and smart buildings (SB). This research highlights the potential of sixth-generation (6G) wireless networks and IoT to transform indoor environments through enhanced automation, intelligence, and adaptability. They first analyze the limitations of current IoT-based systems and then explore advanced 6G technologies, including Integrated Sensing and Communication (ISAC), Machine Learning (ML), Visible Light Communication (VLC), Reconfigurable Intelligent Surfaces (RIS), and Blockchain (BC). These technologies aim to address challenges related to scalability, connectivity, and interoperability that current IoT/5G models face (Ullah et al., 2025).

Luna et al. (2021), in a study titled "An Innovative Joint Energy and Demand Management System for Smart Homes Based on Model Predictive Control, Hybrid Storage System, and Quality of Experience Concepts," describe an innovative, general-purpose, Quality of Experience (QoE)-aware energy management system. This system is designed to monitor the performance of a smart home, implementing economic performance and demand management (DM) measures while considering user comfort and adopting QoE metrics (Luna et al., 2021).

Schaffer et al. (2024), in an article titled "Exploring Thermal Smart Meter Data: A Co-Clustering-Based Approach for Analyzing Energy Consumption in Single-Family Homes," examine the digitization of the district heating sector and the installation of smart heat meters (SHMs). These meters generate data with unprecedented temporal precision, enabling large-scale analysis of thermal energy consumption patterns. Such data assist policymakers and utility companies in transforming the building sector (Schaffer et al., 2024).

Tada et al. (2024), in a study titled "Development of a 'Smart Hazard Map' for Smartphones," which displays building damage and evacuation measures caused by tsunamis and river flooding at the user's current location, state that Japan frequently faces tsunamis, floods, and natural disasters, yet public awareness of these risks as a personal concern remains suboptimal. To enhance citizens' sense of responsibility, a Smart Hazard Map (SHM) was designed, utilizing spatial data to provide information such as tsunami/flood depth, building damage, time remaining until flooding, and evacuation routes based on individual methods (Tada et al., 2024).

Sami Yousefi (2025), in a study titled "Designing Human-Centric Smart Housing to Enhance Quality of Life," aimed to develop a design-oriented framework for human-centric smart housing, where advanced technologies serve to improve residents' quality of life and satisfaction. The study adopted a qualitative approach using grounded theory methodology. Data analysis was conducted through theoretical coding and thematic analysis, leading to the extraction of key concepts and patterns in human-centric smart housing design. The findings indicate that human-centric smart housing design requires the integration of three fundamental elements: adaptive technologies, flexible design principles, and resident satisfaction criteria. The proposed framework demonstrates how integrating these elements can create an intelligent yet human-centered space capable of responding to residents' evolving needs. This framework can serve as a guide for architects and designers in creating future residential spaces (Sami Yousefi, 2025).

Qaderi and Qalambardezfouli (2024), in a study titled "User-Friendly Design Process in Residential Spaces Damaged by Floods in Chabahar," explored the issue of housing provision in the context of post-industrialization challenges, which have become a global concern, with Iran being no exception, particularly in cities like Chabahar that face fundamental crises due to recent floods. With advancements in modern technologies and changing lifestyles, the need for smart and flexible buildings to meet residents' evolving needs has become more pronounced. This study aimed to design flood-damaged residential spaces in Chabahar in a user-friendly manner using smart architecture. The findings highlight the critical importance of prioritizing safety and comfort in user-friendly housing design through the application of smart architecture (Qaderi & Qalambardezfouli, 2024).

Darban Astaneh (2024), in a study titled "Development Model for Smart Housing in Rural Areas," argues that as rural communities modernize and are exposed to globalization, residents' lifestyles undergo significant changes. These changes present challenges, the most prominent of which is housing construction in rural areas. Daily life in rural regions varies due to specific territorial and geographical conditions. To develop a smart housing model for a smart village, the study examines three key factors: climate-responsive design as a distinguishing feature of rural housing, integration of required housing functions with cultural considerations in rural home design, and the impact of contemporary factors and conditions on rural housing construction and the transformation of rural landscapes. To this end, the study utilizes findings from previous research and documentary analysis from various countries. After grouping variables and factors and conceptualizing them, a development model for smart housing in rural areas is proposed (Darban Astaneh, 2024).

Rezaei and Hooshmandpour (2024), in a study titled "Achieving Ideal Housing with the Aid of Smart Materials," state that the rapid pace of urbanization and increased migration to cities have led to numerous environmental challenges, making the connection with nature increasingly essential. With advancements in computer science and electronics in recent decades and the emergence of new needs and conditions, many human challenges have been addressed; however, the relationship between humans, architecture, and nature has not improved. The study aims to explore and achieve ideal housing through the use of smart materials. The findings demonstrate that designing with smart materials facilitates a proper connection with nature and contributes to the creation of ideal housing (Rezaei & Hooshmandpour, 2024).

Rakhshaninasab et al. (2023), in a study titled "Analysis of Urban Planning Indicators Affecting Smart Housing in Shiraz," note that providing housing that meets safety, comfort, and energy efficiency requirements is among the most fundamental human needs. In this regard, smart building systems, leveraging the latest technologies, create ideal conditions in buildings (Rakhshaninasab et al., 2023).

Anabestani et al. (2023), in a study titled "Identifying Key Drivers Affecting the Establishment of Smart Cities Based on IoT Technology (Case Study: Mashhad Metropolis)," explore smart cities, which are typically developed through advanced infrastructure and modern information and communication technologies, with IoT enabling connectivity among smart devices. The results indicate that the use of big data analytics provides intelligent solutions for future cities, allowing urban management and citizens to access vast amounts of real-time environmental data. Based on this data, decisions, actions, and plans are formulated. Given its current and future population absorption capacity, the city of Mashhad needs to align with modern transformations to optimize resource use, enhance facilities, and create the necessary infrastructure to meet future needs (Table 1).

Based on the theories discussed above, the concept of a smart city has undergone significant transformations over time. Initially, the smart city was conceptualized as a "smart machine," aiming to delegate urban management to information technology to minimize human error. Subsequently, it was described as a physical and virtual environment for learning, embodying a tangible dimension. Later, with the introduction of a forward-looking approach, the smart city concept emphasized participatory processes. After integrating with the notion of an electronic city, the dimensions of human and social capital were incorporated. Given this evolutionary trajectory, it is evident that enhancing the quality of life in smart cities is now a central focus and is recognized as one of the highest

Table 1: Theorists' Perspectives on Smartization

Theorist	Perspective
Zuboff's Theory	Zuboff's "Smart Machine" theory posits that a smart city leverages information and communication technologies for automation, micro-level processes, and activities. It also emphasizes intelligent production and management processes.
The View of Coninus	Komninos (2009) views smart cities as environments with physical and virtual spaces conducive to learning and innovation, encompassing research and development, technology transfer, innovation financing, product development, and networking (Komninos, 2009).
The Theory of Griffinger et al.	According to Giffinger et al., a smart city exhibits excellent performance and a forward-looking approach in areas such as economy, people, governance, mobility, environment, and citizens' quality of life. It fosters self-sufficient, aware, and independent citizens through intelligent integration, participation, and activity (Giffinger et al., 2007).
Elharder and Rhodes's Theory	This Theory, building on the smart machine concept, emphasizes a collaborative process in smart cities. It involves city management, communities, businesses, research institutions, and other stakeholders working within a defined framework to drive innovation and urban transformation, focusing on engaging communities, organizations, and businesses.
Harrison et al.'s Theory	Proposed in 2010, Harrison et al. describe a smart city as an equipped, integrated, interconnected, and intelligent urban system. It is equipped with tools for collecting and integrating real-time data using sensors, measurement devices, personal devices, cameras, smartphones, medical equipment for emergencies, social networks like the web, and similar systems, enabling data collection and processing as human sensors (Harmon, 2015).
Tim Campbell	Campbell argues that a smart city engages in learning, relearning, and adaptation to new conditions through education-driven networks, metrics, and feedback processes. He believes cities have significant learning potential, which can be optimally utilized through information technology to enhance urban improvement processes, emphasizing learning, relearning, and adaptive cities.
Alberto's Theory	According to Alberto, smart cities are characterized by highways and broadband networks connecting homes, businesses, schools, and libraries. They also include applications built on information sharing and exchange.
Kotkin and Caraglio's Theory	Kotkin et al. (2013) view smart cities as extending beyond environmental sustainability to include infrastructure and livability, steering toward economic sustainability (Kotkin & Cox, 2013). Caraglio et al. (2009), based on research across 70 European cities, emphasize investment in human and social capital and traditional (transport) and modern (ICT) infrastructure to promote sustainable economic growth and a higher quality of life through participatory governance and intelligent natural resource management (Caraglio et al., 2009).

conceptual levels of a smart city, particularly in the context of smart living.

MATERIALS AND METHODS

The present study was conducted in the form of applied research with a descriptive-analytical method in terms of purpose. First, after studying the theoretical foundations in the field of smart cities and smart urban housing, the analysis indicators were extracted. Then, using indicators and measurable metrics in the form of a web-based questionnaire, it was investigated in District 6 of Tehran.

The size of the statistical population is the population living in District 6 of Tehran, and the sample size based on the Cochran formula is 384 people. The sampling method was based on cluster sampling.

The main research questions involve identifying the dimensions and indicators of the Internet of Things (IoT) on urban smart housing and ultimately proposing a model to establish an appropriate framework for the region.

The most important methods of collecting information in this research are observation, survey studies, and documentary methods using library tools (library resources, articles, domestic and foreign books, reputable publications, and websites). First, the indicators were confirmed through interviews with experts, and then the indicators were evaluated in the form of a questionnaire using SPSS software in the form of descriptive and inferential tests. The conceptual model of the research is depicted (Figure 1). Finally, for the final analysis of the data and presentation of the smart housing model with emphasis on the Internet of Things, the desired model was designed in the form of Amos software (Figure 2).

District 6 is one of the oldest of Tehran's 22 districts, located in the heart of the city. Covering an area of approximately 2,138 hectares, it accounts for about 3.3% of Tehran's total surface area. The municipality of District 6 in Tehran Province consists of 6 zones and 14 neighborhoods. The district has a population of over 250,000, with more than 30% of governmental, administrative, institutional, and banking buildings situated within its boundaries. District 6 is bordered by District 3 to the north, District 2 to the west, District 7 to the east, and Districts 10, 11, and 12 to the south. Among the key physical characteristics of this district are its central location in the city and the presence of buildings with diverse functions, including educational, administrative, service-oriented, governmental, and national institutions.

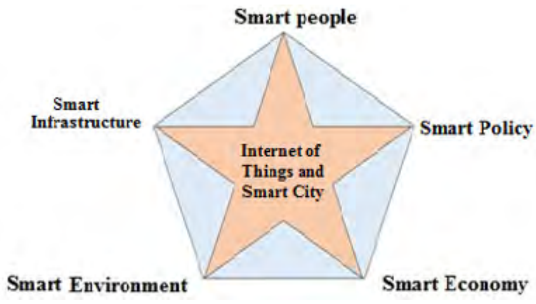

Fig. 1: Conceptual Model of the Study

Fig. 2: Illustration of an IoT-Based Smart City (Source: Mousavi Davijani, 2020, 3)

Additionally, the district has access to major transportation routes: it is connected to Hemmat, Modares, and Chamran highways from the north, east, and west, respectively, and to Revolution Street (the largest east-west axis) from the south. The largest north-south axis of Tehran, Valiasr Street, passes through the center of this district. Due to its numerous administrative, commercial, educational, and recreational centers and high traffic volume, District 6 is also considered one of Tehran's polluted areas (Figure 3).

RESULTS AND DISCUSSION

A smart city preserves and enhances the well-being of its residents in both the long and medium term, achieving the highest quality of life. Creating a better state of relative sustainability in a city requires evaluating the characteristics that influence the input and output model. To address this question, it can be stated that to achieve smartization in District 6 of Tehran, aimed at improving residents' quality of life and identifying the dimensions and components that assist in reaching this goal (Table 2 & Table 3).

The results of the Pearson correlation coefficient analysis for the components of a smart city, as shown in Table 3, indicate the following:

- There is a statistically significant relationship between smart environment and smart infrastructure.
- There is a statistically significant relationship between a smart environment and smart people.
- There is a statistically significant relationship between a smart economy and smart living.
- However, no statistically significant relationship was observed between smart city policies and the other variables, indicating that the current urban management policies are not in a favorable state in terms of smart city indicators (Table 4 & Table 5 & Figure 4).

Research Results

The research results indicate that the first value represents the correlation coefficient, which ranges between -1 and 1. The second value represents the significance level or P-value; if

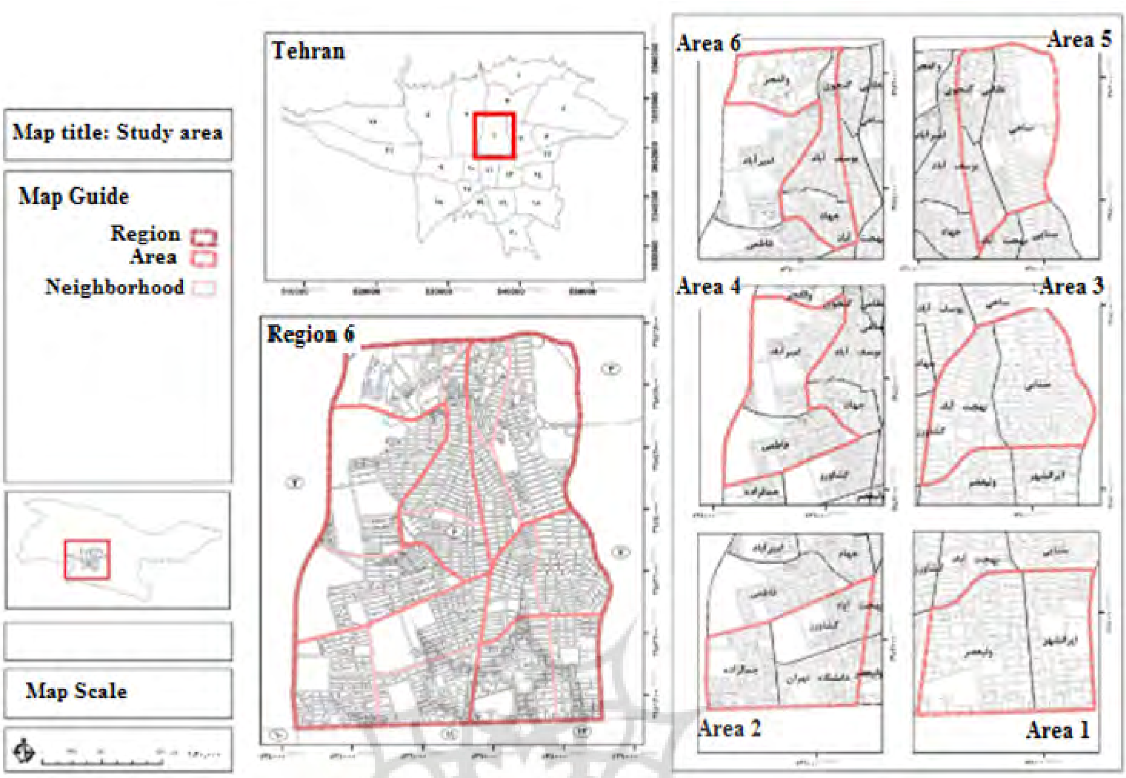

Fig. 3: Map of the Study Area

Table 2: Dimensions and Components of the Present Study

No	Dimension	Components	
1	Smart Policy	Public and social participation;	S1
		- Policy transparency;	S2
		Municipalities informing citizens about urban projects and programs;	S3
		- Citizen participation in municipal decision-making.	S4
2	Smart Infrastructure	Intelligent traffic control;	Z1
		- Smart parking;	Z2
		Smart traffic lights;	Z3
		- Automated emergency response;	Z4
		Smart streets;	Z5
		- Smart school buses;	Z6
3	Smart Economy	- Fostering innovation and entrepreneurship spirit;	E1
		- Education level of creative and entrepreneurial individuals;	E2
		- Securing funding for innovative and new businesses;	E3
		- Identifying innovative ideas for smartization and their application in the economy;	E4
		- Promoting competition in businesses to identify innovative and more effective entrepreneurial approaches;	E5
4	Smart Environment	- Encouraging optimal energy consumption;	M1
		- Promoting the use of public transportation;	M2
		- Timely waste collection;	M3
		- Environmental smartization in response to weather conditions;	M4
		- Smartization of water pipelines;	M5

Continiue of Table 2: Dimensions and Components of the Present Study

No	Dimension	Components	
5	Smart People	- Remote home control capabilities;	P1
		- Real-time reporting of consumer energy consumption;	P2
		- Use of solar panels;	P3
		- Energy storage systems;	P4
		- Creation of electronic health cards;	P5
		- Installation of security sensors and cameras in public passages and pathways;	P6

Table 3: Calculation of Pearson Correlation Coefficient for Research Dimensions

			Estimate	S.E.	C.R.	P	Label
S1	<---	Siyast	1.000				
S2	<---	Siyast	-.020	.270	-.074	.941	par_1
S3	<---	Siyast	-1.222	.567	-2.155	.031	par_2
S4	<---	Siyast	.315	.372	.847	.397	par_3
Z1	<---	Zirsakht	1.000				
Z2	<---	Zirsakht	1.335	.267	4.993	***	par_4
Z3	<---	Zirsakht	1.216	.249	4.891	***	par_5
Z4	<---	Zirsakht	.419	.240	1.750	.080	par_6
Z5	<---	Zirsakht	.156	.230	.676	.499	par_7
Z6	<---	Zirsakht	.326	.261	1.250	.211	par_8
EC5	<---	Eghtesad	1.000				
EC4	<---	Eghtesad	25.467	329.374	.077	.938	par_9
EC3	<---	Eghtesad	54.716	707.413	.077	.938	par_10
EC2	<---	Eghtesad	51.946	671.603	.077	.938	par_11
EC1	<---	Eghtesad	54.416	703.533	.077	.938	par_12
M5	<---	Mohit	1.000				
M4	<---	Mohit	1.174	.270	4.354	***	par_13
M3	<---	Mohit	.937	.220	4.254	***	par_14
M2	<---	Mohit	.843	.334	2.522	.012	par_15
M1	<---	Mohit	.286	.280	1.021	.307	par_16
P6	<---	People	1.000				
P5	<---	People	3.238	2.372	1.365	.172	par_17
P4	<---	People	.821	.873	.941	.347	par_18
P3	<---	People	.578	.774	.746	.455	par_19
P2	<---	People	1.813	1.404	1.291	.197	par_20
P1	<---	People	2.383	1.771	1.346	.178	par_21
S1	<---	Siyast	1.000				
S2	<---	Siyast	-.020	.270	-.074	.941	par_1
S3	<---	Siyast	-1.222	.567	-2.155	.031	par_2
S4	<---	Siyast	.315	.372	.847	.397	par_3
Z1	<---	Zirsakht	1.000				
Z2	<---	Zirsakht	1.335	.267	4.993	***	par_4
Z3	<---	Zirsakht	1.216	.249	4.891	***	par_5
Z4	<---	Zirsakht	.419	.240	1.750	.080	par_6

Continiue of Table 3: Calculation of Pearson Correlation Coefficient for Research Dimensions

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Z5	<---	Zirsakht	.156	.230	.676	.499	par_7
Z6	<---	Zirsakht	.326	.261	1.250	.211	par_8
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EC4	<---	Eghtesad	25.467	329.374	.077	.938	par_9
EC3	<---	Eghtesad	54.716	707.413	.077	.938	par_10
EC2	<---	Eghtesad	51.946	671.603	.077	.938	par_11
EC1	<---	Eghtesad	54.416	703.533	.077	.938	par_12
M5	<---	Mohit	1.000				
M4	<---	Mohit	1.174	.270	4.354	***	par_13
M3	<---	Mohit	.937	.220	4.254	***	par_14
M2	<---	Mohit	.843	.334	2.522	.012	par_15
M1	<---	Mohit	.286	.280	1.021	.307	par_16
P6	<---	People	1.000				
P5	<---	People	3.238	2.372	1.365	.172	par_17
P4	<---	People	.821	.873	.941	.347	par_18
P3	<---	People	.578	.774	.746	.455	par_19
P2	<---	People	1.813	1.404	1.291	.197	par_20
P1	<---	People	2.383	1.771	1.346	.178	par_21

this value is less than 0.05, it indicates a statistically significant relationship between the two variables. Here, the correlation coefficient, ranging between 0.70 and 1, signifies a strong correlation. Additionally, based on the significance level (Sig), it is observed that the relationships between the variables in this study are statistically significant.

Smart Housing Model in District 6 of Tehran with an Emphasis on the Internet of Things

This section of the research relies on communication infrastructure, practical applications of IoT, and active citizen participation. This model can reduce energy consumption, enhance security, and improve residents' quality of life. However, its success depends on addressing infrastructure challenges and increasing public awareness. Therefore, analyzing the factors influencing smartization is essential, and these factors are examined as follows:

Smart Policy: Government participation in investments, policy transparency, citizen involvement in municipal decision-making, etc.

Smart Infrastructure: Communication networks (5G, Wi-Fi), sensors and data centers, energy management (smart thermostats, solar panels), cameras, smart locks, control applications, enhanced security, etc.

Smart Economy: E-government, e-commerce, digital entrepreneurship, digital literacy, etc.

Smart Environment: Monitoring air, water, and soil quality and health, measuring pollutants, dust, and suspended particles in the air, urban green spaces, water, and waste management, etc.

Smart People: Internet access, use of smart transportation, development of digital citizenship culture, digital innovation, and entrepreneurship (Figure 5 & Figure 6).

CONCLUSION

Today, the role of smart technologies, particularly information and communication technologies, in achieving sustainable urban development goals is globally recognized. Smart cities are regarded as a promising tool for advancing toward these objectives. A key aspect of a smart city is the fundamental transformation of how urban services are delivered. The establishment of a smart city is not primarily about technological advancements in information technology but rather about improving and transforming urban services. A comprehensive review of the literature reveals that various cities pursue different objectives in their smartization efforts, tailored to their specific conditions and priorities, with the overarching goal of enhancing quality of life. The findings of this study can serve as a valuable guide for urban managers and officials in identifying priorities for smartization in District 6 of Tehran and adopting appropriate strategies and actions.

Table 4: Weights of Dimensions and Components of the Study

	P1	P2	P3	P4	P5	P6	M1	M2	M3	M4	M5	EC1	EC2	EC3	EC4	EC5	Z6	Z5	Z4	Z3	Z2	Z1	S4	S3	S2	S1
People	.066	.046	.012	.017	.073	.018	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
Mohit	.000	.000	.000	.000	.000	.000	.018	.045	.254	.242	.159	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
Eghtesad	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.005	.006	.005	.001	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
Zirsakht	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.012	.007	.020	.245	.357	.077	.000	.000	.000	.000
Siyast	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.028	-.187	-.003	.085

Fig. 4: Ranking Chart of the Study's Dimensions and Components

Table 5: Results of the Pearson Test for Research Dimensions

Correlations		Smart People	Smart Environ-ment	Smart Economy	Smart Policy	Smart Infra-structure
Smart People	Pearson Correlation	1	.899**	.914**	.880**	.951**
	Sig. (2-tailed)		.000	.000	.000	.000
	N	50	50	50	50	50
Smart Environ-ment	Pearson Correlation	.899**	1	.938**	.978**	.920**
	Sig. (2-tailed)	.000		.000	.000	.000
	N	50	50	50	50	50
Smart Economy	Pearson Correlation	.914**	.938**	1	.938**	.945**
	Sig. (2-tailed)	.000	.000		.000	.000
	N	50	50	50	50	50
Smart Policy	Pearson Correlation	.880**	.978**	.938**	1	.916**
	Sig. (2-tailed)	.000	.000	.000		.000
	N	50	50	50	50	50
Smart Infrastruc-ture	Pearson Correlation	.951**	.920**	.945**	.916**	1
	Sig. (2-tailed)	.000	.000	.000	.000	
	N	50	50	50	50	50
**. Correlation is significant at the 0.01 level (2-tailed).						

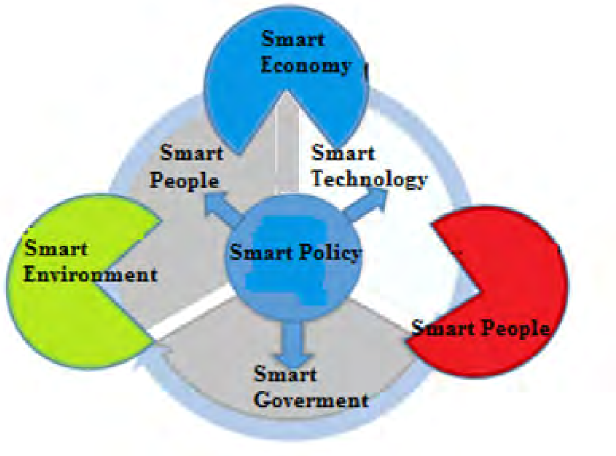

Fig. 5: IoT Technology Framework for Realizing Urban Smart Housing

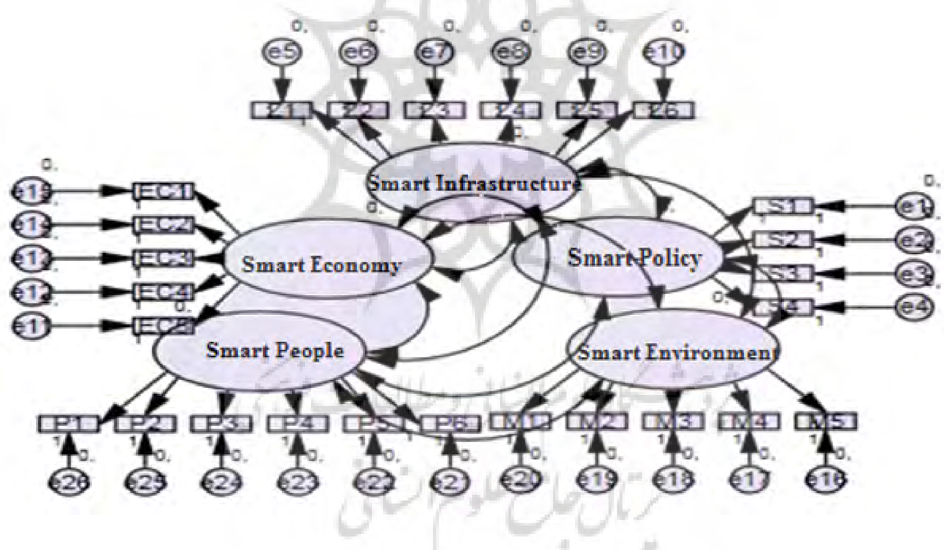

Fig. 6: IoT Technology Framework for Realizing Urban Smart Housing Using Amos Software (Source: Authors' Studies, 2025)

In this study, after identifying the dimensions of a smart city to guide urban areas toward smartization, these dimensions and their components were evaluated in District 6 of Tehran from the perspectives of experts and citizens. The statistical data analysis revealed that current policies for implementing smart city indicators are not in a favorable state, as they remain rooted in traditional objectives with no forward-looking vision. The Internet of Things (IoT), as an emerging technology, enables the collection and processing of data by connecting various objects and devices to the internet. This technology has wide-ranging applications in various domains, including housing. In smart housing, IoT can be utilized for purposes such as energy management, enhancing housing security, employing smart sensors, controlling lighting and temperature, and providing greater amenities for residents' comfort, thereby playing a significant role in achieving urban smart housing.

The decision to adopt a smartization approach for District 6 of Tehran to enhance residents' quality of life was driven by the approach's comprehensive consideration of all aspects of a region and the provision of tailored solutions. Developing a smart economy, improving urban management, enhancing the quality of services, elevating citizens' living standards, and preparing citizens for life in an information society are among the objectives of smart cities. In line with the issues discussed, the following recommendations are proposed to improve the current situation and achieve the desired state:

Energy consumption optimization (reducing costs and pollution):

- Installing smart thermostats (such as Nest or Iranian models such as Linkp);
- LED lighting management system with motion sensors;
- Monitoring water consumption with IoT sensors;

Increased security and surveillance (protection against urban threats):

- Smart cameras with facial recognition (such as Ring or local models);
- Digital door locks with biometric access;
- IoT-connected smoke and gas sensors;

Enhancing comfort and automation (a more convenient life in a bustling city):

- Voice assistants such as Google Home or Alexa (Persian versions);
- Smart curtains and an automatic ventilation system;
- Integration with smart transportation;

Sustainability and integration with Tehran's smart city (a regional approach):

- Local education and support (holding free workshops in regional cultural centers, such as the Aras Baran Cultural Center);
- Focus on sustainability (promoting low-cost IoT models with solar energy for older buildings).

AUTHOR CONTRIBUTIONS

S. Teymouri conducted the literature review, data analysis and interpretation, manuscript preparation, and manuscript editing. S. Moradi conducted the literature review, data collection, and manuscript preparation.

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CONFLICT OF INTEREST

The authors declare no potential conflict of interest regarding the publication of this work. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancy, have been completely witnessed by the authors.

REFERENCES

Akande, A., Cabral, P., Gomes, P., & Casteleyn, S. (2019). The Lisbon ranking for smart sustainable cities in Europe. Sustainable cities and society, 44, 475-487. https://doi.org/10.1016/j.scs.2018.10.009

Alavi, A. H., Jiao, P., Buttlar, W. G., & Lajnef, N. (2018). Internet of Things-enabled smart cities: State-of-the-art and future trends. Measurement, 129, 589-606. http://dx.doi.org/10.1016/j.measurement.2018.07.067

Albert, S. (2003). Smarten up: a guide to creating a smart community. Trafford Publishing.

Anabestani, A., Kalantari, M., & Niknami, N. (2023). Identifying key drivers affecting the establishment of IoT-based smart cities (Case study: Mashhad Metropolis). Journal of Urban Economics and Planning, 4(1), 232-248 (In Persian). http://dx.doi.org/10.22034/UEP.2023.390907.1346

Ashton, K. (2009). That 'internet of things' thing. RFID journal, 22(7), 97-114.

Capello, R., Caragliu, A., & Nijkamp, P. (2009). Territorial capital and regional growth: Increasing returns in cognitive knowledge use (No. 09-059/3). Tinbergen Institute Discussion Paper.

Castellani, F., Della Fornace, M., Falvo, M. C., Ferretti, A., & Santi, F. (2024). Labeling and assessment of energy and sustainability performances in the civil sector: The case study of ESA-ESRIN in Rome. Journal of Cleaner Production, 453, 142135. https://doi.org/10.1016/j.jclepro.2024.142135

Darban Astaneh, A. (2024). Development model for smart housing in rural areas. First National Conference on Human Settlements in Iran, Tehran (In Persian). https://www.en.symposia.ir/HSICONF01

Edwards, K. J., Jones, R. B., Shenton, D., Page, T., Maramba, I., Warren, A., & Chatterjee, A. (2021). The use of smart speakers in care home residents: an implementation study. Journal of Medical Internet Research, 23(12), e26767. https://doi.org/10.2196/26767

Giffinger, R., Fertner, C., Kramar, H., Kalasek, R., Pichler-Milanovic, N., & Meijers, E. J. (2007). Smart cities. Ranking of European medium-sized cities. Final report.

Harmon, R. R., Castro-Leon, E. G., & Bhide, S. (2015). Smart cities and the Internet of Things. In 2015, Portland International Conference on Management of Engineering and Technology (PICMET) (pp. 485-494). IEEE. http://dx.doi.org/10.1109/PICMET.2015.7273174

Harrison, C., Eckman, B., Hamilton, R., Hartswick, P., Kalagnanam, J., Paraszczak, J., & Williams, P. (2010). Foundations for smarter cities. IBM Journal of research and development, 54(4), 1-16. https://doi.org/10.1147/

JRD.2010.2048257

Hosseinpour, F., & Houdseni, H. (2024). The role of local management in providing housing for low-income groups (Case study: Tehran urban management). Journal of Fine Arts: Architecture and Urban Planning, 29(3), 73-89 (In Persian). https://doi.org/10.22059/jfaup.2025.387846.673039

Ivanov, D., Smith, J., Petrov, A., Wang, J., Volkov, S., & Zhao, D. (2025). Integrating IoT Sensors into Smart City Data Visualization Systems. Preprint. http://dx.doi.org/10.13140/RG.2.2.27610.04808

Kamalnejad, A. (2024). The role of the Internet of Things in renewable energy resources. Journal of Computational Methods in Engineering Sciences, 2(1), 16-20. https://doi.org/10.22034/cmes.2024.2041110.1029

Khan, A., Aslam, S., Aurangzeb, K., Alhussein, M., & Javaid, N. (2022). Multiscale modeling in smart cities: A survey on applications, current trends, and challenges. Sustainable cities and society, 78, 103517. https://doi.org/10.1016/j.scs.2021.103517

Kim, K. H. (2025). Evaluation of Korea's Housing Policy and Suggestions for Improving Policy. Evidence-Based Policy Analysis: Lessons Learned, 291. http://dx.doi.org/10.1093/oso/9780197801826.003.0014

Komninos, N. (2009). Intelligent Cities: R and D offshoring, web 2.0 product development, and globalization of innovation systems.

Kotkin, J., & Cox, W. (2013). The future of the affluent American city. Cityscape, 15(3), 203-208. https://www.huduser.gov/periodicals/cityscpe/vol15num3/ch14.pdf

Lee, J., & Yoon, Y. (2022). Hierarchy table of indicators and measures for the current status assessment of urban roads in smart cities. Sustainable Cities and Society, 77, 103532. https://doi.org/10.1016/j.scs.2021.103532

Liugailite-Radzvickene, L. R. J. (2014).¬Going to be an intelligent city. Social and Behavioral Science, 15, 116-120.¬ http://dx.doi.org/ 10.1016/j.sbspro.2014.11.131

Luna-Perejón, F., Muñoz-Saavedra, L., Castellano-Domínguez, J. M., & Domínguez-Morales, M. (2021). IoT garment for a remote elderly care network. Biomedical Signal Processing and Control, 69, 102848. https://doi.org/10.1016/j.bspc.2021.102848

Mohammadi, F. G., Shenavarmasouleh, F., Amini, M. H., & Reza Arabnia, H. (2022). Data analytics for smart cities: Challenges and promises. Cyberphysical Smart Cities Infrastructures: Optimal Operation and Intelligent Decision Making, 13-27 (In Persian). http://dx.doi.org/10.1002/9781119748342.ch2

Mora, L., Bolici, R., & Deakin, M. (2017). The first two decades of smart-city research: A bibliometric analysis. Journal of Urban Technology, 24(1), 3-27. http://dx.doi.org/10.1080/10630732.2017.1285123

Mousavi Davijani, M. (2020). The role of the Internet of Things in the development of smart cities: Innovative applications, opportunities, and challenges. Fifth International Conference on Applied Research in Computer, Electrical, and Information Technology, September 15, 2020 (In Persian). https://civilica.com/doc/1123579/

Novak, A., Šumrada, T., & Juvančič, L. (2024). Are farmers' minds really too elusive to capture? A novel evaluation framework for the knowledge transfer initiatives in agriculture. International Journal of Agricultural Sustainability, 22(1), 2379877. https://doi.org/10.1080/14735903.2024.2379877

Pourahmad, A., Ziyari, K., Hataminejad, H., & Parsa Pashahabadi, S. (2018). Smart city: Explaining the necessities and requirements for Tehran's Smartization. New Attitudes in Human Geography (Human Geography Quarterly), 10(2), 1-22 (In Persian). file:///C:/Users/user/Downloads/article.pdf

Qaderi, H., & Qalambardezfouli, R. (2024). User-friendly design process in flood-damaged residential spaces in Chabahar using smart architecture. Tenth Annual International Congress on Civil Engineering, Architecture, and Urban Development, Tehran (In Persian). https://civilica.com/doc/2153977/

Rakhshaninasab, H., Chaharrahi, M., & Soleimani Damaneh, M. (2023). Analysis of urban planning indicators affecting smart housing in Shiraz. Journal of Urban Environmental Policy, 3(2), 17-34 (In Persian). https://doi.org/10.30495/juepd.2023.1980290.1146

Rezaei, A., & Hooshmandpour, Y. (2024). Achieving ideal housing with the aid of smart materials. Ninth International Conference on Architecture, Restoration, Urban Planning, and Sustainable Environment, Hamadan (In Persian). https://www.en.symposia.ir/ARUES13

Sami Yousefi, F. (2025). Designing human-centric smart housing to enhance quality of life. Second National Conference on Future Cities, Creativity, Innovation, and Sustainable Development, 1-9 (In Persian). https://civilica.com/doc/2313893/

Schaefer Morabito, M. (2010). Understanding community policing as an innovation: Patterns of adoption. Crime & Delinquency, 56(4), 564-587. https://doi.org/10.1177/0011128707311643

Schaffer, M., Vera-Valdés, J. E., & Marszal-Pomianowska, A. (2024). Exploring smart heat meter data: A co-clustering driven approach to analyse the energy use of single-family houses. Applied Energy, 371, 123586. https://doi.org/10.1016/j.apenergy.2024.123586

Sekher, T., & Govil, D. (2022). World Population Day 2022 symposium & launch of United Nations World Population Prospects-2022. Columbia University.

Sharifi, A., & Murayama, A. (2015). Viability of using global standards for neighborhood sustainability assessment: insights from a comparative case study. Journal of Environmental Planning and Management, 58(1), 1-23. https://doi.org/10.1080/09640568.2013.866077

Tada, Y., Suzuki, S., Shiozaki, Y., Kato, K., & Matsumoto, T. (2024). Development of "Smart Hazard Map" for smartphones showing house damage and evacuation actions due to tsunami and river flooding at current locations. Procedia Computer Science, 246, 782-791.

Tehran District 6 Municipality Website To the address: https://www.tehran.ir/6 (In Persian).

Ullah, A., Nadeem, A., Arif, M., Bashir, M. M., & Choi, W. (2025). 6G Internet-of-Things assisted smart homes and buildings: Enabling technologies, opportunities and challenges. Internet of Things, 101658. https://doi.org/10.1016/j.iot.2025.101658

Weber, R. H., & Weber, R. (2010). Internet of Things (Vol. 12). Heidelberg: Springer.

Yadegari, V., Matinfar, A., & Sohrab, S. (2023). Security assessment framework for IoT networks and equipment in smart military facilities. Journal of Security and Protection Research, Imam Hussein University, 12(47), 91-112 (In Persian). https://journals.ihu.ac.ir/article_209331.html