Empowering Accessibility: IoT-Driven Smart Buildings for Elderly and Disabled Individuals

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***Abstract*—This study aims to examine the attitudes of elderly and disabled individuals in Saudi Arabia toward Internet of Things (IoT)-enabled smart home technologies, with specific attention to the influence of demographic variables. The research employed a descriptive survey design, utilizing an online questionnaire distributed to a stratified random sample of 249 participants. Stratification ensured balanced representation across gender, age, educational attainment, employment status, and economic background. Statistical analyses, including Scheffé's post hoc test, revealed generally positive attitudes toward IoT adoption, primarily driven by perceived benefits related to enhanced quality of life, personal safety, and autonomy. Significant differences were identified across several demographic variables: married individuals, employed participants, those with higher education, higher-income groups, and individuals aged 30 to 45 all reported more favorable attitudes. Similarly, individuals with disabilities expressed stronger acceptance compared to their elderly counterparts. In contrast, gender differences were not statistically significant. These findings highlight the need for targeted, inclusive strategies that promote the adoption of IoT technologies across diverse social groups. The study contributes to a deeper understanding of how demographic characteristics shape technology acceptance and underscores the urgency of designing accessible, user-centered smart home systems. Recommendations emphasize public awareness initiatives, affordability measures, and inclusive design practices contributing to digital equity and aligning with the broader objectives of Saudi Vision 2030 for sustainable urban development.**

Keywords*—*IoT; smart home; sustainability; urban development; quality of life; assistive technologies

I. Introduction

Smart home technology plays a pivotal role in the realm of IoT applications. It transforms a traditional household into a connected environment, where various devices communicate with one another via the Internet. This interconnected setup enhances the home's intelligence, connectivity, and effectively automates various aspects of daily life [1]. The concept of smart home technology began to gain prominence in the early twenty-first century, aiming to network and interconnect household devices and equipment. However, researchers have no consensus on the definition of smart homes [2]. Information and Communication Technologies (ICTs) have been seamlessly integrated into consumer products like phones and televisions, as well as urban infrastructure and networks, significantly improving the quality of life [3]. A smart home represents a fusion of technology and services tailored to enhance the living environment's efficiency, comfort, and security for its occupants [4].

The integration of these home systems allows them to communicate with one another via a central control unit. This enables the execution of pre-programmed scenarios or operational modes, facilitating single-button or voice-controlled management of various home systems, simultaneously [5]. One of the most significant aspects of a smart home is its capacity to provide environmental control, allowing remote or automated management of essential home components like thermostats, ventilation systems, lighting fixtures, kitchen appliances, and various household devices. This automation not only simplifies household management but also reduces the workload of residents, contributing to their overall convenience [6].

Despite the numerous advantages and benefits of smart homes, they are often viewed as somewhat inconvenient and novel technology due to certain drawbacks. These drawbacks encompass a high initial cost, limited availability, and a shortage of experts in the field for installation and maintenance [7]. Moreover, concerns related to weak security and privacy are a significant issue for users or potential users. Information collected by these devices is typically transmitted over open networks like the Internet or via systems provided by service providers. This can potentially result in data breaches and access by hackers, exposing individuals to real risks such as theft or extortion [8].

This study explores the growing role of smart homes in IoT applications while addressing concerns such as privacy violations and weak security due to potential remote breaches [9]. Research in South Korea and Malaysia has shown that many users have negative attitudes toward adopting IoT in smart homes [10]. Additionally, many homeowners remain unaware of the benefits of smart home technology, contributing to reluctance to adopt [11]. Previous studies have primarily focused on younger users while overlooking elderly individuals

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and people with disabilities [12]. Furthermore, research on smart home adoption in Arab countries remains limited. This study seeks to examine attitudes toward IoT in smart homes among elderly and disabled individuals in Saudi Arabia. It also investigates whether demographic factors such as gender, age, education, and economic status influence these attitudes [13].

This study makes several significant contributions to the literature on IoT and smart home systems. First, it investigates the influence of demographic factors, such as gender, age, education, employment, and economic status, on attitudes toward adopting IoT in smart homes. This focus provides insights into how diverse populations perceive and interact with smart home technologies. Second, the study highlights the potential of IoT to enhance the quality of life for elderly individuals and people with disabilities, emphasizing its role in promoting independence, safety, and convenience. This study delivers deep knowledge to user-centered design in smart home systems, aligning with Saudi Vision 2030's goals of fostering sustainable urban development and inclusivity. By addressing the attitudes and motivations of underrepresented groups, this research offers practical recommendations for governments, policymakers, and technology companies to develop inclusive and accessible smart home solutions.

This work is structured to include (see Section II) reviews of related works on smart home technology and IoT adoption, focusing on elderly and disabled populations. A description of the methodology used, including the sample, data collection tools, and analysis techniques, has been presented in Section III. Section IV presents the results, highlighting the influence of demographic factors on attitudes towards IoT adoption. Section V presents the discussion of the study. A conclusion is given to provide recommendations for future research and policy implications in Section VI. Limitations of the study are presented in Section VII.

II. Related Works

A. Societal Influence and the Need for User-Centered Design

The evolution of smart homes is fundamentally driven by societal perceptions, emphasizing the necessity of a user-centered design rather than a purely technological orientation. Smart home systems deliver clear advantages in security, energy efficiency, and accessibility via automated lighting, temperature regulation, and appliance management. For example, occupancy sensors dynamically optimize lighting and HVAC performance to reduce energy consumption while enhancing comfort [8, 10, 11].

A recent systematic review highlights that demographic factors, including gender, age, and education, are consistently among the strongest moderators affecting consumer adoption and acceptance of smart home IoT devices [14]. Another empirical study reports that income and education levels significantly influence intention to use smart home services, whereas gender and age may not always have a consistent direct effect. Specifically, those with higher education and income exhibit greater receptivity to IoT technologies, while adoption intention tends to vary by residential type and prior experience [13]. Furthermore, cutting-edge research from 2024 proposes human-centered explain ability frameworks for AI-driven smart home systems, advocating for interfaces that users can intuitively understand, thereby strengthening trust, transparency, and acceptance [15]. Similarly, another study leveraging large language models (LLMs) to personalize smart home interactions demonstrated a measurable improvement of around a 52% increase in user satisfaction ratings, underscoring the value of preference-based, user-adaptive design [16].

B. Smart Homes in Assisted Living Contexts

Smart home solutions are increasingly being designed within assisted living environments to support active aging, independence, and adaptive care, with a focus on features such as fall detection, emergency response, medication adherence, and sensory integration [12, 13].

Recent developments in smart home platforms have incorporated technologies such as radio frequency identification (RFID), wearable sensors, wireless networks, and artificial intelligence to achieve seamless interoperability and personalized functionality. These integrations enhance user autonomy and minimize dependence on continuous direct caregiving, particularly in assisted living environments [17]. Recent studies expand this field by demonstrating how smart flooring powered by the Internet of Things and deep learning analytics can achieve up to 98% fall detection sensitivity and 99% accuracy using non-intrusive sensors embedded under carpets, an approach that balances effectiveness, privacy, and everyday functionality [18].

Furthermore, innovations in assistive technology now include automated medication dispensers, wearable tracking devices with geofencing capabilities, and AI-powered remote monitoring, which collectively enable immediate support for healthcare adherence and rapid alerts to caregivers in emergencies [19].

For example, specialized IoT-based smart home systems for individuals with dementia have demonstrated their ability to monitor medication use, track wandering behaviors, and support remote healthcare functions through NFC-enabled pillboxes and environmental sensors, facilitating safe and independent living [20]. Advanced commercial solutions highlight the progress made in smart assisted living[21]. This device achieves up to 99.5% accuracy in detecting falls even in the case of partial obstruction, features two-way audio communication, and automatically alerts caregivers or emergency services upon detection, demonstrating the practicality and cost-effectiveness of smart technologies in private residences [21, 22]. Together, these developments reflect a clear evolution in smart home technologies, ranging from general automation to highly personalized, user-centric systems. These technologies are designed not only to meet the functional needs of the elderly or those with cognitive disabilities, but also to preserve their dignity, minimize intrusion, and enhance their independence in their familiar home environments.

C. Barriers to Adoption: Privacy, Security, and Awareness

Research in South Korea and Malaysia has shown that many users have negative attitudes toward adopting IoT in smart homes, often due to concerns about privacy and security [23]. Furthermore, many homeowners remain unaware of the benefits

of smart home technology, which contributes to their reluctance to adopt it [24].

Recent empirical evidence from across Asia reveals a range of critical barriers to the adoption of IoT-based smart home technologies, with privacy concerns and cybersecurity vulnerabilities emerging as the most prominent challenges. In addition to these technical and ethical concerns, a pervasive lack of user awareness regarding the potential benefits of IoT devices significantly contributes to users' reluctance, thereby impeding the broader integration of such technologies into residential settings. Furthermore, limited security literacy among users and inadequate adherence to data confidentiality practices further exacerbate these issues, highlighting the urgent need for targeted awareness initiatives and robust security frameworks to support secure and informed adoption [14, 25, 26].

D. Gaps in Literature: Marginalized Populations and Regional Contexts

Previous empirical studies have predominantly centered on younger, technologically adept users, often overlooking key marginalized groups such as elderly individuals and people with disabilities [3, 27]. This oversight has resulted in a limited understanding of how these populations perceive and interact with smart home IoT technologies. In addition, there is a significant paucity of research focusing on the adoption of smart home innovations within Arab contexts, particularly in Gulf countries such as Saudi Arabia [27, 28]. To address these research gaps, the present study investigates the attitudes of elderly and disabled individuals in Saudi Arabia toward smart home technologies supported by the Internet of Things (IoT). Specifically, the study explores the extent to which various demographic variables influence these attitudes. These variables include gender, marital status, educational level, employment status, age, economic status, previous experience with smart technologies, and user category (e.g., elderly vs. disabled). By examining these dimensions, the research aims to provide a more inclusive and context-sensitive understanding of the factors shaping technology adoption among underrepresented populations in the Arab world.

III. Methodology and Approaches

A descriptive survey method has been conducted to quantitatively depict the current state of affairs. This method is well-suited to the study's nature, enabling it to address its inquiries and fulfill its objectives effectively. The questionnaire served as the primary data collection tool to gather descriptive quantitative data regarding the attitudes of elderly individuals and those with disabilities regarding the utilization of IoT in smart home systems.

A. Sample of the Study

A stratified random sample of 249 elderly people and people with disabilities was selected from the Najran region in the Kingdom of Saudi Arabia. The participants contributed to answering the questionnaire tool in collaboration with Candle of Hope Association for People with Disabilities and Noor Najran Association for Women and People with Disabilities. The questionnaire has been electronically distributed to a study sample via an electronic link by use of Google Forms services. The questionnaire has been published in collaboration with authorities from the previously stated entities through personal email and mobile apps for study participants. The demographic distribution showed significant participation of both women and men in the survey. In Table I, the demographic description of the targeted groups is equally distributed among demographic variables. It depicts the distribution of research sample members based on demographic factors (gender, marital status, educational level, employment status, age, experience, category, and economic status).

TABLE I. Sample Distribution based on Demographic Variables, Namely: Gender, Marital Status, Educational Level, Employment Status, Age, Experience, Category, and Economic Status

Variable	Value Label	No.	Percentage (%)
Gender	Male	106	43
	Female	143	57
Marital status	Married	106	43
	Single	143	57
Educational level	Illiterate	94	38
	School	89	36
	University	66	27
Employment status	Work	128	51
	No work	121	49
Age	15-30	56	22
	30-45	69	28
	45-60	76	31
	+60	48	19
Experience	Likely to use	131	53
	Use	118	47
Category	The Elderly	137	55
	People with disabilities	112	45
Economic status	Average or below	124	50
	Above average	125	50
Total		249	100

B. Tools of the Study

The development of the questionnaire was guided by a clear objective: to assess attitudes toward the utilization of Internet of Things (IoT) technologies in smart home systems, particularly in relation to improving the quality of life for elderly and disabled individuals. This instrument was designed based on a thorough review of relevant theoretical frameworks and empirical studies. Key references included national resources such as the Saudi Association for Individuals with Disabilities and international studies by Marn-Daz [29], Wilson et al. [3] and others [30, 31]. These sources provided validated constructs and item formats that were adapted to the context of this study to ensure both content relevance and conceptual alignment within the target population. The rationale for using a structured questionnaire was to systematically capture subjective attitudes and perceptions in a standardized format that facilitates quantitative analysis. The survey was constructed in two sections: the first collected demographic and contextual

information; the second included 11 Likert-scale items measuring the perceived impact of IoT use on quality of life. The five-point Likert scale (ranging from "strongly agree" to "strongly disagree") was employed to allow for nuanced responses while maintaining analytic simplicity. Score ranges were determined based on prior psychometric studies, enabling consistent interpretation of response trends. However, the design and implementation of the questionnaire are subject to several limitations. First, the reliance on self-reported data inherently introduces potential biases, such as social desirability bias, recall bias, or respondents' limited awareness of IoT functionalities. Although the anonymity of responses was preserved to mitigate some of these effects, such biases may still influence the results. Second, the sample was selected based on accessibility and willingness to participate, which may restrict the generalizability of findings to the broader population of elderly and disabled individuals. This self-selection bias, coupled with possible underrepresentation of individuals with severe disabilities or low technological literacy, limits the extent to which the results can be extrapolated. Third, while the questionnaire underwent expert validation and pilot testing for clarity and relevance, its psychometric properties (e.g., construct validity, test-retest reliability) warrant further investigation in future studies with larger and more diverse samples.

C. Validity of the Tool

The initial version of the study tool has been presented to ten faculty experts, specializing in computer science, networks, information, and communication systems, as well as psychological measurement and evaluation, hailing from various Saudi universities. Experts have examined the relevance of each item to the overall tool, scrutinized the linguistic formulation for accuracy, and assessed the tool's appropriateness for reaching the study's objectives. The experts confirmed that the tool was well-suited for fulfilling the study's aims. The questionnaire was administered to a preliminary sample of thirty elderly individuals and people with disabilities from the study area, a subset outside the main study population. Afterwards, the correlation coefficients of each item with the total tool score were computed. The results are detailed in Table II.

TABLE II. CORRELATION COEFFICIENTS AMONG VARIABLES AND THE TOTAL SCORE OF THE TOOL AT THE SIGNIFICANT LEVEL OF 0.05

Variable no.	Correlation significance /variable	Variable no.	Correlation significance /variable
1	0.31	7	0.54
2	0.49	8	0.58
3	0.41	9	0.61
4	0.43	10	0.45
5	0.66	11	0.55
6	0.35		

The correlation coefficients of the individual items with the entire tool fell within the range of 0.31 to 0.66, demonstrated acceptable and statistically significant levels (see Table II). As a result, there has no need to remove any of the items from the tool. These findings affirm the tool's validity in accurately measuring the intended aspects.

D. Reliability of the Tool

To ensure the tool's reliability, it was administered to a group of 25 individuals with disabilities, who were not part of the study sample. The tool has initially applied and then reapplied after a two-week interval. The Pearson correlation coefficient has been calculated to determine the consistency of responses across the two administrations of the tool. The reliability coefficient, as assessed through the test-retest method, is 0.88 for the entire tool. The tool's reliability has also been assessed using the internal consistency method, calculated through the "Cronbach's Alpha" equation for the tool. According to this method, the reliability coefficient for the entire tool was 0.79. These results collectively affirm the tool's reliability in consistently measuring the intended aspects. The statistical software SPSS version 23 has been employed for data analysis. To address the first research question, means, standard deviations, and rankings were calculated. The second research question has been tackled through multiple analyses of variance, with subsequent multiple comparisons conducted using Scheffé's method.

IV. RESULTS AND DISCUSSION

According to the variable associated with the level of attitudes towards using IoT in implementing the smart home system, according to the estimates of the study sample members of the elderly and people with disabilities as users and potential users?

Mean value, variance, and rank have been calculated for the responses for the first question of this study about the level of attitudes toward using IoT in implementing the smart home system to support the quality of home life as perceived by the elderly and people with disabilities as users and potential users. Mean values ranged between 3.34 and 3.56, with medium and high ratings (see Table III).

TABLE III. MEANS AND STANDARD DEVIATIONS OF THE LEVEL OF ATTITUDES TOWARD USING IOT IN THE SMART HOME SYSTEM TO SUPPORT THE QUALITY OF HOME LIFE AS PERCEIVED BY THE ELDERLY AND PEOPLE WITH DISABILITIES AS USERS AND POTENTIAL USERS

No.	Items	Mean	SD	Rank	Level
5	I see that this system will provide me with belonging to the home in which I live	3.56	1.31	1	High
3	I believe this system will help me be free from anxiety and stress in my home	3.53	1.18	2	High
9	I believe that this system will enable me to carry out work and tasks within my home easily	3.53	1.08	2	High
1	I believe that this system helps me practice motor activities inside the house with complete freedom	3.49	1.26	3	High
11	I believe that this system will help me practice recreational activities at home with ease	3.49	1.19	3	High
2	I believe this system will help me have a healthy atmosphere at home	3.46	1.19	4	High
4	I think this system will help me improve my overall mood at home	3.44	1.32	5	High

7	I believe that this system will help me enjoy a strong social network around my home	3.39	1.16	6	Medium
10	I believe that this system will enable me to go out and return to my home easily and conveniently	3.39	1.18	6	Medium
6	I believe that this system has a high ability to protect my privacy	3.35	1.26	7	Medium
8	I see that this system will keep me close to my family members	3.34	1.20	8	Medium
	Total degree	3.45	0.910		High

The mean value of the total score for the level of attitudes towards using IoT in the smart home system, according to the estimates of the study sample members of the elderly and people with disabilities as users and potential users, was 3.45±0.91. The responses that see that the smart system will provide them with belonging to the home in which they live came in first place with the highest mean value of 3.56±131, with a high degree. Item (3) "I believe that this system will help me to be free from anxiety and psychological pressure in my home", and item (9) "I believe that this system will enable me to carry out work and tasks inside my home easily", scored second with the same mean values of 3.53 and the high level of degree. Item (8) "I see that this system will provide me with closeness to my family members" ranked last with a mean of 3.34 and a medium degree.

Mean values and standard deviations have been calculated for the responses of the study sample members regarding the level of attitudes towards the use of IoT in applying the smart home system to support the quality of home life for the elderly and people with disabilities as users and potential users according to demographic factors (gender, marital status, level Educational, employment status, age, experience, category, economic status). Table IV depicts the results. Results associated with the effect of demographic factors (gender, marital status, educational level, employment status, age, experience, class, economic status) attitudes towards using IoT in the smart home system, according to the estimates of the study's sample of elderly people and disabled people as users and potential users presents evidence of variations among the mean responses of the study sample participants concerning their attitudes toward using IoT in smart home systems (see Table IV).

TABLE IV. MEAN AND VARIANCE OF THE RESPONSES OF THE MEMBERS REGARDING THE LEVEL OF KNOWLEDGE TOWARDS USING IOT IN THE SMART HOME, ACCORDING TO DEMOGRAPHIC FACTORS

Variable	Category	Mean	No.	SD
Gender	Male	3.36	106	0.93
	Female	3.53	143	0.88
Marital status	Married	3.82	106	0.96
	Single	3.18	143	0.76
Educational level	Illiterate	3.37	94	0.80
	School	3.28	89	0.91
	University	3.79	66	0.97
	Work	3.67	128	1.00
Employment status	No work	3.23	121	0.75
Age	15-30	3.58	56	0.82
	30-45	3.70	69	0.96
	45-60	3.25	76	0.88
	+60	3.27	48	0.89
Experience	Likely to use	3.17	131	0.74
	Use	3.77	118	0.97
Category	The Elderly	3.28	137	0.90
	People with disabilities	3.67	112	0.87
Economic status	Average or below	3.10	124	0.75
	Above average	3.80	125	0.92

These variations are associated with various demographic factors, including gender, marital status, educational level, employment status, age, experience, category, and economic status. To determine the statistical significance of these differences at the 0.05 level, multiple analyses of variance were employed. The outcomes are depicted in Table V.

TABLE V. MULTIPLE VARIANCE ANALYSIS OF THE LEVEL OF ATTITUDES TOWARDS THE USE OF IOT IN THE SMART HOME SYSTEMS ACCORDING TO DEMOGRAPHIC FACTORS

Variable	Type I Sum of Squares	df	Square Mean	F	Significance
Gender	1.779	1	1.779	2.884	.091
Marital status	23.700	1	23.700	38.413	.000
Educational level	8.137	2	4.069	6.595	.002
Employment status	4.134	1	4.134	6.700	.010
Age	5.768	3	1.923	3.117	.027
Experience	8.746	1	8.746	14.176	.000
Category	2.534	1	2.534	4.107	.044
Economic status	5.337	1	5.337	8.650	.004
Error	146.221	237	.617		
Total	3175.877	249			

There have been no significant differences in the level of attitudes towards using IoT in the smart home system due to the gender variable (F value = 1.779), which was statistically significant at the level of 0.091. There were statistically significant differences at the level of attitudes towards using IoT in the smart home system due to the marital status variable in favor of the married group (F value = 38.413) was statistically significant. There were statistical differences due to the employment status variable for the group of workers (employees) (F value = 6.700) scored a statistical significance of 0.010; the experience variable for the use category (I use it) (F value = 14.176); the category variable in favor of the category of people with disabilities (F value = 4.107); and the economic status variable in favor of a group above the average (F value = 8.650) was statistically significant at 0.004. There were significant differences (sig. level of 0.05) in the level of attitudes towards using IoT in the smart home system due to the

educational level variable (P value = 6.595) and statistically significant at 0.002; the age variable (F value = 3.117) statistically significant at 0.027. To demonstrate the significance of the differences according to the variables of educational level and age, multiple comparisons were used by Scheffé's method (see Table VI).

TABLE VI. MULTIPLE COMPARISONS USING SCHEFFÉ'S METHOD FOR THE SIGNIFICANCE OF THE DIFFERENCES IN THE LEVEL OF ATTITUDES TOWARD THE USE OF IOT IN THE SMART HOME SYSTEM ACCORDING TO EDUCATIONAL LEVEL AND AGE

Level of Education (I)	level of Education (J)	I-J diff. mean	Significant level
University	School	0.51 (significant level of 0.05)	0.000
	Illiterate	0.42 (significant level of 0.05)	0.004
Age (I)	Age (J)	Mean Difference (I-J)	Sig.
15 -30	(30 -45)	0.12	0.863
	(45 -60)	0.44 (significant level of 0.05)	0.010
	+ 60	0.43 (significant level of 0.05)	0.042

There have been significant differences (mean = 0.51, sig. level 0.000) among responses in the level of attitudes toward the use of IoT in the smart home system due to the educational level between the two categories of university and school for the former. Significances were also found between the university and illiterate categories in favor of the university group. The value of the Mean Difference 0.42) was statistically significant at the level of 0.007. There have been also shown a statistical difference (at the significant level of 0.05) for the responses of the study sample members in the level of attitudes toward the use of IoT in the smart home system for 30 to 45-year-old category (mean value of 0.12±0.863), and both the category of 45-60-year-old (mean value of 0.44±0.01) and over 60-year-old category for the benefit of the former (mean value of 0.43±0.042) (see Table VI).

V. DISCUSSION

Results showed that the level of attitudes towards using IoT in the smart home system, according to the estimates of the study sample members, including elderly people and people with disabilities as users and potential users, was significant. The result may be attributed to the fact that smart home and building applications have become a reality that can enhance human lives, including the elderly and people with disabilities [13]. With the advantages of using IoT in the smart home system application, ranging from voice-activated lighting to automated security systems, it provides a lot of convenience and extraordinary safety benefits. Elderly and people with disabilities have complete control over all home appliances and tools from one device, such as a mobile phone or remote control, so there is no need to wander around the house with effort, as well as managing the house from the outside as well [32]. It emphasized the integration of smart technology to ensure the well-being and quality of life for humans and Saudi society [27]. Hence, the positive attitude towards technology and the appropriate individual awareness of the importance of using IoT in applying the smart home system to provide the needs and services of the elderly and people with disabilities easily and conveniently has contributed to the high attitudes towards this modern technology. This result differs from the study of Chang and Nam [13], which showed negative attitudes among the population in the Republic of Korea towards the use of IoT in the smart home by its users or potential users. It also disagrees with that in the study [23], which showed that Malaysian residents are extremely reluctant to adopt IoT in the smart home. Perhaps this difference may be due to factors of time, place, and social and cultural conditions between these two studies and the current study. This result may benefit local and international technology companies in enhancing the local and global market with high-quality products and devices that meet the needs of the elderly and people with disabilities in using IoT in implementing the smart home system. It improves the quality of living and well-being of elderly and disabled individuals and provides special services and care appropriate to their abilities and potential. Thus, it is reflected in national belonging through the promotion of human and social values in society and the right of everyone to live in dignity, and from an economic standpoint, it enhances state revenues and national economic income.

The study examined the impact of demographic factors, including gender, marital status, education, employment status, age, experience, social class, and economic status, on attitudes toward IoT adoption in smart home systems among elderly and disabled individuals, revealing no statistically significant differences based on gender. This may be caused by the similar awareness among the study sample members, regardless of their gender, about the importance of using IoT in the smart home system in daily life and household activities and requirements, and its role in facilitating their lives and living [33]. No statistically significant differences were found due to the marital status variable in favor of the married group[13]. The result may be attributed to the role of spouses in providing great support to one another. Hence, they need to realize the value of this technology in enhancing that role between them as well as its role in relieving pressure and tension in relationships between couples, because it enables them to complete work and tasks easily. There have been significant differences attributed to the employment status variable and in favor of the working group (employees). The result may be attributed to the study sample members' awareness of the importance of this system, "IoT in implementing the smart home system", in facilitating the process of leaving the home and returning to it with all comfort and ease. Also, it plays a role in commuting to work by providing technological devices to serve them, which is reflected in their feelings and desire to use this system with welcome and love, and to encourage others to use it [5]. There were statistically significant differences attributed to the experience variable and in favor of the usage category (use it). The result may be attributed to the awareness of the people who use this system and interact with it of its importance. It includes many additional tools and characteristics that distinguish it from the traditional home, enabling them to deal with and rely on themselves, and making their home life more quality, easy, and convenient. There were statistically significant differences attributed to the category variable and in favor of the category of people with disabilities. The result may be attributed to the fact that individuals with disabilities possess some of the

cognitive and mental abilities that enable them to use this system and deal with it, in contrast to the elderly, who worry and feel afraid of using this system. In addition, most of them suffer from chronic diseases or mental illnesses such as Alzheimer's, which affects the level of their attitudes towards this system and its importance in their lives [28].

There were significant differences attributed to the economic situation variable and in favor of a group above the average. The result may be due to the person's economic factor playing a major role in their desire to own and use such a system. Therefore, people with high income or high economic levels are informed of everything new about this system to become more familiar with it in terms of its benefits, how to deal with it, and the possibility of using it currently or in the future, which affects their attitudes towards this system [7]. There were statistically significant differences due to the educational level variable in favor of the university category. The result may be attributed to the role of higher education in providing individuals with the opportunity to learn new things and know everything about technology and its great role in improving human life. Hence, the study members who received a university education may have gained experience in how to obtain reliable sources about this system, its benefits, how to deal with it, and the possibility of using it currently or in the future. There were statistically significant differences attributed to the age variable, favoring the 30 to 45 age group. This result may be explained by younger individuals' greater willingness to adopt, explore, and engage with technology, as well as their lower levels of apprehension toward its use compared to older age groups [27]. Therefore, their attitudes toward this system and their acquisition of sufficient knowledge about it, its benefits, how to deal with it, and the possibility of using it currently or in the future greatly affect their attitudes toward this system in terms of use or the probability of using it.

This study attempted to collect quantitative data and analyze it descriptively to explore the influence of demographic factors (gender, marital status, educational level, employment status, age, experience, category, economic status) as users or potential users of IoT in the smart home system and attitudes towards it. It also showed how it might affect them when they decide to adopt this system or encourage others to adopt it, and what differences or lack thereof were found based on those demographic factors. This may help in understanding and increasing the awareness of governments and technical companies specialized in smart homes that end consumers do not respond to those services proposed to them in the same way. This result may be due to the difference between them in the demographic factors discussed in the current study, which necessitates expanding the circle of spreading the culture of smart homes in a major selling space, such as international and local premium markets, for example. The influence of factors and circumstances surrounding people, including the elderly and people with disabilities, may affect their attitudes and purchasing attitudes toward this system. It also requires technical commercial companies specialized in this system to develop an organized and thoughtful strategic plan. It includes a large variety of diverse services that are integrated into using IoT in implementing the smart home system to attract the largest possible segments of society, including the elderly and people with disabilities.

VI. Conclusion and Recommendations

This study concluded that elderly individuals and people with disabilities in Saudi Arabia generally exhibit positive attitudes toward the adoption of IoT-based smart home technologies, particularly those who are married, employed, better educated, and from higher-income groups. However, certain demographic factors, such as being unmarried, unemployed, of lower socioeconomic status, or having limited educational attainment, were associated with lower adoption enthusiasm. These findings highlight the potential of IoT to improve quality of life, autonomy, and safety for marginalized groups, but also underscore the presence of critical barriers that must be addressed through targeted interventions. In light of these findings, several actionable recommendations are proposed. Government agencies, particularly the Ministry of Human Resources and Social Development and the Ministry of Communications and Information Technology, should establish inclusive digital policies and launch national awareness campaigns tailored to underserved populations. These should include digital literacy initiatives, financial support schemes, and the integration of smart technologies into broader Vision 2030 strategies to enhance social equity and digital transformation. For technology developers and solution providers, there is a clear imperative to adopt user-centered design approaches that ensure smart home systems are affordable, intuitive, and responsive to the needs of elderly and disabled users. This includes simplifying interfaces, offering Arabic language support, and addressing security and privacy concerns that may hinder adoption. Civil society organizations and charitable institutions are also encouraged to play an active role in bridging the digital divide. Through community outreach and partnerships with public institutions, these organizations can advocate for the practical benefits of IoT and facilitate equitable access to smart technologies among low-income and vulnerable individuals. Lastly, the academic community should pursue in-depth qualitative research to uncover the psychosocial and cultural dimensions that influence IoT adoption. Special attention should be given to rural populations and those with limited technological exposure to develop evidence-based strategies that ensure inclusive innovation. These efforts will contribute significantly to building a sustainable, digitally empowered society in alignment with Saudi Arabia's Vision 2030.

VII. Study's Limitations

The results of this study are limited to the following: The study was limited to investigating the topic of attitudes towards the use of the Internet of Things (IoT) in the smart home system from the point of view of the elderly and people with disabilities as users and potential users. It was also determined to explore the impact of some demographic factors such as (gender, marital status, educational level, employment status, age, experience, class, economic status) on these attitudes. In addition, the study was limited to the opinions of a sample of the elderly (over 60 years old) and people with disabilities (over 15 years old to 60 years old) from Najran region in the south of the Kingdom of

Saudi Arabia, in the period from June to July of the year 2023. Finally, one tool, the questionnaire, was used in the data collection process, so generalizing the results depends on the accuracy in extracting its validity and reliability implications and the seriousness of the respondents in answering them.

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ETHICAL APPROVAL

This scientific research carries ethical approval from the Standing Committee for Scientific Research Ethics in the Research Deanship of Najran University, Saudi Arabia. Reference No.: 010118-022124-DS. Accredited as a local committee by the National Committee for Bioethics at King Abdulaziz City for Science and Technology (HAPO-11-N-102).

INFORMED CONSENT STATEMENT

Informed consent was obtained from all study participants.

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