Impact of Smart Homes on Residential Living

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Abstract-Smart homes are residences that are equipped with internet connected devices that are transforming the way we live and they offer so many benefits in our day to day lives from remote control appliances for comfort,energy savings and security systems that protect our houses however all these features comes with few drawbacks security vulnerabilities, privacy concerns, and compatibility challenges associated with this emerging technology. This research paper seeks to explore the multifaceted implications of smart homes, examining their technological underpinnings, societal ramifications, and policy implications. By critically analysing the opportunities and challenges associated with smart home adoption, this study aims to provide insights that inform decision-making processes and shape the future trajectory of residential living.

Keywords- Internet of Things (IoT) |Home Automation |Smart Devices |Connected Home |Remote Control |Convenience |Security |Energy Efficiency |Personalization

INTRODUCTION

Smart homes epitomize the convergence of technology and domestic life, offering residents unprecedented control and convenience through interconnected devices. These homes are equipped with sensors, actuators, and communication technologies that enable automation and remote management of various household functions, from lighting and climate control to security and entertainment. Through the Internet of Things (IoT), residents can effortlessly monitor and adjust their living environment from anywhere, using smartphones or voice commands. The implications of smart homes extend beyond mere convenience. They have the potential to significantly increase the energy economy, reduce the environmental impact and improve the standard of living in general. In addition, by enabling remote monitoring of health indicators and facilitating initiatives for the ageing in place movement, smart home technologies are positioned to revolutionise healthcare. However, alongside their promises, smart homes present challenges such as privacy concerns, cybersecurity risks, and issues of interoperability and accessibility. Addressing these challenges requires thoughtful design, robust regulations, and inclusive approaches to ensure that the benefits of smart homes are equitably distributed across society. In essence, smart homes represent a paradigm shift in residential living, promising to create more intelligent, efficient, and responsive living spaces while also necessitating careful consideration of the ethical, social, and practical implications they entail.

REVIEW OF LITERATURE

The study delves into the recent advancements in Smart Home Systems (SHSs), offering a thorough examination of the various technological aspects involved[1][4]. It scrutinises the adoption of different approaches, microcontrollers, sensors, networking technologies, computational techniques, user interfaces, security protocols, and services related to SHSs. Identifying six common microcontrollers, 17 different types of sensors, and 11 significant technical approaches, the research sheds light on prevailing trends and preferences in SHS development. Notably, there's a growing inclination towards multifaceted SHSs employing multiple approaches and IoT-based systems, indicative of a quest for enhanced functionality. Furthermore, the study underscores the increasing importance placed on network and physical security in light of potential vulnerabilities. It also predicts a pivotal role for smartphone application-based interfaces due to their accessibility and superior functionality. [4] Overall, the findings suggest a trajectory towards interconnected, secure, and user-

centric smart home technologies, poised to improve living standards amidst population growth and rapid industrialization. This thorough analysis serves to guide future research endeavours, emphasising the need for continued innovation in pursuit of safer and more efficient SHSs.

In the contemporary digital landscape, the Internet of Things (IoT) has seamlessly integrated into people's daily routines, emerging as a pivotal component of the Fourth Industrial Revolution (IR 4.0) and exerting a profound influence across various spheres of human life. Recognizing its significant benefits, researchers are urged to prioritise the exploration of IoT-enabled Smart Home Technology (IoT-SHT). This study identifies four distinct usage types and fifteen impact factors associated with IoT-SHT, categorising its impact into four dimensions to elucidate its potential in enhancing people's Quality of Life (QoL). To achieve a deeper understanding within a social context, quantitative approaches such as questionnaire surveys involving a larger sample size are recommended. These studies aim to statistically analyse the relationship between usage behaviour and outcomes, facilitating broader generalisations of findings. Addressing growing concerns surrounding consumer data privacy, it is essential to investigate negative influencing factors such as IoT network uncertainties and resistance to lifestyle changes. This proactive approach aims to alleviate apprehensions among potential users unfamiliar with the technology. Similarly, researchers are encouraged to explore adverse impacts, such as the development of sedentary habits and over-reliance on smart technology, to foster a comprehensive understanding of IoT-SHE's implications. Through diligent inquiry and consideration of both positive and negative aspects, researchers can contribute to the responsible and informed advancement of IoT-SHT, ensuring its beneficial integration into society.

The Web of Things (WoT) encompasses diverse applications across various domains, with the Internet of Things (IoT) already integrated into industrial Wireless Sensor Networks (WSNs) and Smart Home Systems. Despite its potential benefits, IoT and Smart Homes encounter several challenges, which could be mitigated with the aid of emerging technologies. This paper outlines the encountered issues and forthcoming challenges within IoT and Smart Homes. Its primary objectives are to introduce the concept of IoT and its application in creating intelligent homes that prioritise security, convenience, and enhancing quality of life. However, integrating IoT into homes introduces new security vulnerabilities, necessitating robust security measures. While advanced technologies offer both opportunities and risks, IoT-based Smart Homes face security threats from both internal and external sources. Compromising security in such environments jeopardises user privacy, personal data, and even the safety of occupants. Thus, proactive measures are imperative to enhance the security and suitability of smart homes. However, the selection of specific solutions should be informed by a clear understanding of the desired security objectives and underlying motivations. Home automation stands as a pivotal IoT application, promising simpler and more enjoyable living experiences for all. A project aiming to develop an IoT-based smart home automation system prioritised safety and security, leveraging contemporary technologies to achieve satisfactory results, notably facilitated by 4G connectivity.

The term "smart" has evolved to refer to any technology that has artificial intelligence. This technology is characterised by its ability to receive information from its environment and respond appropriately[5]. Smart technology, which prioritises human well-being, is the driving force behind novel ideas such as the smart home system (SHS), which promotes worldwide progress using device connectivity and information exchange. Researchers' interest in smart home technology has increased, advancing the area, driven by the benefits of smart technology and the possibility of a sizable worldwide market. The smart home industry, which includes home automation and management, has a lot of potential. The term "smart home" refers to intelligent living that encompasses broader technology ramifications, going beyond simple human housing[9][11]. A component of ubiquitous computing, smart home systems (SHSs) integrate smart technology into homes to improve convenience, healthcare, safety, security, comfort, and energy efficiency—all of which contribute to an elevated quality of life. SHSs provide a range of services, such as internet-based home control, aged care, and remote monitoring systems that enable telecommunication, through automated and remote appliance control.

Information technology was developed by Davis (1989) and has become an important part of many IT

devices, including smart home devices[14][9]. Examines the factors that influence users' needs to use new technologies, from perceived benefits to practical issues. Although smart homes are attractive, issues such as complexity, cost, and security risk hinder adoption; A good understanding and characteristics of users such as age, gender, education, income, housing type, and previous experiences also affect adoption decisions. [9]Understanding these changes is important for developing strategies to improve the smart home and address users' diverse needs and preferences. As technology continues to advance, addressing these factors becomes important to encourage widespread adoption and integration of smart home solutions into daily life.

Smart home technology is transforming real estate, increasing property value and increasing sales. Smart homes with connected devices and electronics are attracting the attention of buyers looking for solutions to everyday problems[13][15]. Pre-installed smart devices can save buyers time and energy, make products more valuable, and increase sales. In addition, smart home appliances increase sales by offering convenience and modern devices. Buyers are willing to pay a premium for homes with smart features because they are aware of the added value. [10] Moreover, smart homes attract tenants who are willing to pay more rent due to the convenience and advanced technology they provide, highlighting their impact on the real estate market. Smart home technology appeals to Generation Y due to its convenience and environmentally friendly features, but it also appeals to a wider audience with its affordable price and usefulness. Millennials value the functionality and control as well as the security benefits that smart devices provide. But the appeal of smart homes isn't limited to millennials, as they meet the needs of many groups seeking home improvements, energy management and convenience.

IOT is basically a digital system that is used to compute, store and analyse data which makes the life of an individual easier. [14][4]A smart home is an easy application that makes the user feel safe, provides comfort. Smart home applications are usually accessible through a remote control or smartphones. Research done in Malaysia proves that iot has made the lives of people much easier in sense of comfort, security, surveillance, family communication as it is able to provide real time information. Iot has been able

to connect families in distance and help with the feeling of belongingness. also in the health care sector. The internet has surely changed the lives of humans drastically and the lifestyle of people. The advancement of technology over the decades has been the result of life today. A lot of technological advancement has helped in accessibility of information and materials to people at a cheaper cost which helps in widespread usage. Ai generated smart homes are energy efficient and environmentally friendly.[14] Although these devices consume a lot of energy, their efficiency is tested by the use of automation built in which allows the system to turn off when not in use , these features prove that these applications do not need human assistance . using smart thermostats jointly with automated sun shadings to optimise energy usage, and reducing water consumption. Smart TVs, Smart lighting systems, Smart thermostats, Smart door locks and garage door openers, Smart security cameras and systems, Smart pet and lawn care, Smart kitchen appliances, Smart household monitors, Smart plugs and many more.

If your house is equipped with a smart system that can automate chores by connecting to your appliances, it is considered a smart home. Smart homes have many impacts and benefits to the society and especially towards the working busy class of people.[15] The major impacts of Smart homes, allow an individual to have greater control of their energy usages, turning on and off lights , adjusting temperatures etc. Smart homes provide energy efficiency data that can be applied to be more mindful of wastage and ecologically beneficial. Smart homes also allow an individual to save a precious amount of time, example; an individual could automate an appliance to make coffee for them before they wake up and that would save them time from waking up and making it themselves Finally another impact it has is on energy saving as many people in the world forget to turn off their lights before leaving their house and they can now access this information after leaving the house and switch the lights off from a different location, hence saving energy.[13][20] The only drawback of smart homes is that the cost is very high to set it up and if the smart device fails for any reason it could disrupt the whole system connected to it. Smart homes are the way of the future and by 2030 it is said that every 2 out of 3 homes in the world will have some smart home

device ranging from an Alexa to a fully automated system

DATA COLLECTION, INTERPRETATION AND RESULT

For a higher standard of life, a smart house integrates services and technology via home networking. Using a variety of technologies, it equips household appliances with the ability to monitor and control more intelligently as well as to interact harmonically and influentially with one another. This results in the automation of routine household tasks and activities, either entirely without user intervention or with user remote control in a way that is simpler, safer, more convenient, and less expensive.

It is anticipated that by 2024, there will be more smart homes than 400 million. The most well-known market category is that of smart speakers, with 171 million devices supplied in 2022. By 2024, the market's volume is expected to double.(fig 1)

As per (fig 1), Between 2023 and 2028, 424.5 million users (+117.69 percent) are expected to constantly expand in the smart home industry, according to the worldwide indicator "Smart Homes by Segment." In 2028, the indicator is predicted to reach a new peak of 785.16 million users, after the ninth year of continuous increases. Notably, throughout the previous years, the smart home market's "Smart Homes by Segment" indication has been steadily rising.

In the smart home industry, the worldwide indicator "Household Penetration Rate by Segment" was predicted to rise steadily by 16.8 percentage points between 2023 and 2028. In 2028, the indicator is predicted to reach a new top of 33.2 percent, following the ninth year of straight increases. The smart home market's "Household Penetration Rate by Segment" indication has been steadily rising over the past few years, which is noteworthy.

According to data on smart homes, 42.99 million households—less than two-thirds of all households today—used smart home technology in 2019. Since then, the number has increased by 10.2% a year on average, hitting 47.38 million in 2020 and 52.22 million in 2021—the first time it has crossed the 50 million mark.

According to data on smart homes, there were 57.55 million smart houses in 2022, indicating that the number was still rising. Experts blame this trend on more time spent at home as well as technological developments, such as enhanced smart home gadget integration and advances in natural language processing.
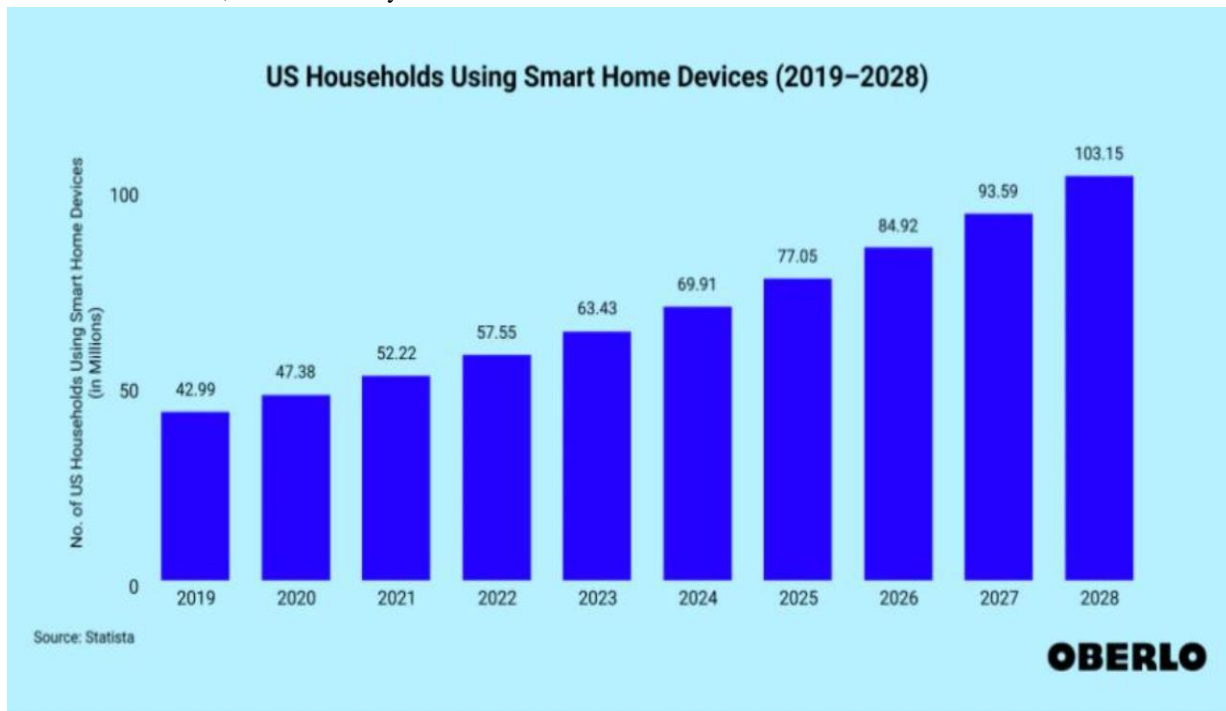
(fig 1)

CONCLUSION

It is anticipated that living in a smart home in the future will be simpler, safer, and less damaging to the environment. Imagine being able to control the oven, thermostat, and even lights remotely using your phone. Smart homes also offer peace of mind thanks to features like smart locks and remote monitoring. In addition to saving you money on electricity, these homes can identify your routines and optimise energy use.

However, as our analysis has revealed, the implications of smart homes extend beyond mere convenience. They have the potential to significantly impact various facets of society, from energy consumption and environmental sustainability to healthcare and urban planning. Yet, challenges such as privacy concerns, cybersecurity risks, and digital inequities must be addressed to ensure that the benefits of smart homes are accessible to all.

Moving forward, it is imperative that stakeholders, including policymakers, designers, and technology developers, collaborate to navigate these challenges effectively. We can use the transformational power of smart homes to build more sustainable, egalitarian, and resilient communities by promoting innovation while putting inclusiveness and ethical issues first. In essence, smart homes represent not just a technological evolution, but a societal one—a shift towards more intelligent, adaptive living environments that hold the promise aimed at raising everyone's standard of living, both privately and publicly.

As a result, a new age in domestic life marked by never-before-seen levels of connectedness, efficiency, and convenience is brought about by the emergence of smart houses. These homes promise improved comfort and security by enabling residents to have more control over their living spaces through the integration of cutting-edge technology like the Internet of Things (IoT).

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