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Urban Design and Planning with Home Automation Engineering and Sustainable Architecture for Residential Spaces in Smart Cities

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Abstract: The design of smart spaces with home automation engineering and sustainable architecture is presented as a transformative model that integrates electronic resources, innovative technological tools, and comfort, implemented in residences as a strategy for sustainable development in smart cities. Electronic resources, physical infrastructure, and digital applications were analyzed, systematizing descriptive tables to classify and present optimal alternatives. The planned space design received support from software applications, architectural design, prototype modeling, and home automation functionalities for housing projects with urban planning, sustainability, and comfort. Unplanned urbanization has triggered environmental, social, and economic issues. The results included a modeled design for livable spaces with innovative technological resources, home automation engineering, and sustainable architecture directed towards safety, energy savings, and intelligent comfort in homes as a sustainable development strategy. An analysis of innovative technological resources for smart space designs was conducted, classifying functionalities to implement feasible projects with sustainability strategies in habitable infrastructures. The proposed modeling of intelligent physical infrastructures opens possibilities contributing to sustainability, counteracting environmental issues, and providing alternatives for habitable spaces, driving regional development through technological innovation. The automated prototype design for residences allowed the identification and classification of optimal resources to adapt the model with a vision of sustainability and feasibility. An environmentally-focused project promotes sustainability, fostering significant actions with feasible proposals for infrastructures supporting the achievement of Sustainable Development Goals.

Keywords: Comfortable housing, habitable spaces, smart cities, sustainable development, urban planning.

1. INTRODUCTION

Cities are interconnected systems addressing complex challenges with economic, ecological, and demographic conditions and changes, supported by urban planning processes, intelligent characteristics, behaviors, models, urban design, and decision support. In the realm of urban design and planning, approaches are needed that can address not only urban complexity but also participatory and collaborative processes in the field of cities with sophisticated technological models significantly aiding as collaboration and communication tools in creating sustainable smart cities (Dembski et al., 2020). The living spaces of smart cities are venturing into technological innovation by applying home automation engineering, architecture, and urban planning to enhance comfort and drive sustainable development.

A smart city requires management, governance, and the incorporation of technical advancements into allied processes. Many developed cities worldwide are already adopting smart city technology. The integration of new technologies is penetrating all fields, surpassing individual impact and benefiting masses at the community and metropolitan levels (Rehman Javed et al., 2022). Technological innovation on a global societal scale is transcendental. Automated processes supported by innovative tools contribute to human tasks and procedures, both in personal activities and the business sector. Automated systems facilitate and streamline procedures, contributing to reduced times and costs, as well as increased productivity and efficiency (Bedolla, 2019).

Digital technology in planning and design processes promotes efficient resource use by creating a virtual representation of the physical world and synchronizing virtual and real connections in real-time using different sensors or electronic elements (Xia et al., 2022). Information and Communication Technologies (ICT) play a significant role in the activities of various sectors of society, as innovation and competitiveness demand the development of automated tools, models, and prototypes to transform and modernize scenarios effectively and efficiently with technological developments in smart system engineering, resources, and intelligent processes to transform society's environments and spaces. The transformation of scenarios or spaces where society operates, such as homes or habitable infrastructures, has adopted intelligent systems and designs to automate and enhance these spaces with technological developments to optimize resources and address dimensions of sustainable development.

The need to improve the aesthetic quality and infrastructure conditions of living environments is a priority of the Sustainable Development Goals (SDGs) established in the 2023 agenda and federal government priority programs that must be addressed by educational and governmental institutions and society at large. It is evident that the aesthetic quality and infrastructure of schools, colleges, and other spaces have been overshadowed by public institutions such as banks, where aesthetics differ significantly from educational centers (Quesada, 2019). Spaces or infrastructures modeled with smart, automated designs and home automation software contribute alternatives for comfort, environmental care, and sustainability.

The National Development Plan 2019-2024 of the Federal Government of Mexico establishes commitments, objectives, and/or priorities for optimal country development. Within the National Development Plan, topics such as sustainable development and the use of science and technology for human and environmental benefit are addressed. The Mexican government is committed to promoting sustainable development, which has become an indispensable factor for well-being in the present era. This formula summarizes essential ethical, social, environmental, and economic mandates that must be applied now to guarantee a minimally habitable and harmonious future. Environmental impact has grown on a global scale, causing significant repercussions for the human population (Semarnat, 2012).

Therefore, sustainable development is the will to improve the quality of life for everyone, including future generations, by reconciling economic growth, social development, and environmental protection (UNESDOC, 2005). Improving the environment for better quality of life requires studies and projects with a focus on sustainable development. In this sense, the study of intelligent spaces designed with sustainable home automation engineering and smart technologies to model comfortable living spaces is an alternative with sustainability strategies that significantly contribute to environmental, social, and economic dimensions.

An intelligent sustainable model of urban development encompasses artistic aspects in architectural and technological elements, from reconfigurable hardware descriptions oriented towards energy efficiency and environmental responsibility to the creation of interconnected fractal systems promoting sustainable development through smart networks to ensure the quality of life for urban inhabitants (Sandoval-Ruíz, 2028). The combination of intelligent systems and home automation technologies makes it possible to optimize various prototypes that will be built following the principles of sustainable architecture, optimizing energy resources to ensure advanced concept homes with environmental intelligence that increase comfort, improve leisure, and facilitate access to information (Chaparro-Peláez et al., 2006).

Domotic or smart architecture for residential homes is based on specific parameters and needs with the aim of generating more sustainable and comfortable environments by applying automated systems with innovative technologies in spaces designed for people. The awareness of breaking paradigms that show intelligence in buildings concentrated in the air, clean energy, and sustainability is crucial. It is impossible to leave the costs due to lack of prevention in the hands of individuals; efforts, technologies, government, and institutions are required (Arencibia-Pardo et al., 2020).

Architectural design with urban planning addresses the approaches of ICT functionalities for smart cities based on models of urban spaces and infrastructures that integrate collaboration tools and platforms with intelligent environmental monitoring systems based on wireless networks and remote reception that meet needs according to infrastructure configurations and electronic resource offerings more comfortably for society (Lyu et al., 2019). A planned space design for housing development requires the analysis of electronic elements, home automation, and software engineering, as well as modeling of habitable spaces with sustainable architecture to address the needs and comfort of people through automated systems.

The work aimed to: 1) Identify electronic elements and resources to analyze characteristics and functionalities of sustainable automated models implemented in smart residential infrastructures; 2) Design an automated prototype model with home automation, software, and electronic resources for residential houses with urban planning that ventures into comfort and technology in smart cities; and 3) Present an automated prototype model with home automation, software, and sustainable architecture to implement sustainable projects of comfortable homes for people.

2. REVIEW OF LITERATURE

The Sustainable Development Goals (SDGs) are an urgent call to action for all countries, providing a global framework to achieve overall development while balancing social, economic, and environmental sustainability. Interdisciplinary studies offer evidence from research on key topics discussed, including aspects of strategy execution. However, many ideas for future work are generated to fulfill the SDGs (Mio et al., 2020). To address environmental issues and climate change, factors determining decisions that can integrate into the formulation and successful adaptation of sustainability-focused strategies have been considered (Chandan-Kumar & Vijaya, 2021).

Environmental issues have negatively impacted, as evidenced by Hurricane OTIS, which devastated the port of Acapulco, Guerrero, Mexico, causing total losses in homes. These circumstances highlight the complexity of social challenges and emphasize the need for specific interventions to mitigate the effects on well-being (Miranda Esteban et al., 2023). Research on the environmental sustainability of domestic facilities designed with available resources, a variety of technologies, and configurations is not clear. Autonomous systems in homes with more sustainable environmental configurations have been considered. Despite significant efforts to address this gap, the energy problem remains a challenge due to the interaction between technology, the economy, the environment, and society (Aberilla et al., 2020).

Technologies have a massive positive impact, although they have also attracted negative attention from users. The early products were mostly small closed networks, followed by large networks such as smart cities, and continued evolving towards the next-generation internet. Following this evolution, architecture and some technologies are compared to analyze security threats within each architectural layer and some mitigation strategies for future developments (Ande et al., 2020).

Smart home systems are considered a sector or an expansion of the automation system that focuses on inspecting common and probable threats to security. In the security analysis of smart home systems, efforts are made to manage automation to increase efficiency. However, these smart spaces seem to gain more tools and controls to manage and control smart spaces or homes (Ibrahim and Nabulsi, 2021). Various institutions have ventured into technological innovation to design modern, smart, and comfortable living spaces, but they have not succeeded in impacting relevant social or environmental issues.

The significant advancement of contemporary applications in various spaces requires a significant emergence of technologies that provide an enhanced vision of energy savings, environmental protection, while maintaining residents' comfort and providing more comprehensive solutions in smart cities. Promoting behavioral change, offering necessary comfort, and implementing a long-term energy policy in an intelligent and sustainable environment will generate sustainable architectural projects for habitable spaces that incorporate technologies, driving infrastructure models that positively impact environmental conservation.

Rapid global urbanization driven by the economy and opportunities has led to profound social changes, including increased infrastructure needs and greater environmental problems. Metropolitan cities, with these trends, require prioritizing urban planning to achieve sustainable urbanization in smart cities (Saraswat et al., 2024). Urban renewal includes changes in the spatial pattern of the area based on characteristics, socializing and interacting with others to improve physical, economic, opportunity, social, cultural, and environmental conditions in the area. This transformation has demonstrated the importance of the availability of space with cultural value and improving the aesthetics of the city to promote economic development by focusing on infrastructure development (Husni Thamrin et al., 2024).

Automated systems with electronic resources, technological web tools, and elements of home automation have been introduced in the construction of living spaces to automate the functionalities of modern and comfortable homes, ensuring safety and well-being. Singh et al. (2021) suggest additional features that can enhance architectural design and improve overall security efficiency. In this regard, the design of prototype smart spaces for physical infrastructure modeled with home automation and sustainability could be replicated with better functionalities in smart cities, promoting sustainability.

Automated services with wireless networks and integrated resources pose several challenges in terms of secure data exchange, architectural framework, and resource efficiency. Since energy costs represent a considerable portion of network expenses, energy efficiency has to become a crucial design criterion for modern networking methods. Creating energy-efficient models to balance efficiency with performance is essential (Mosood et al., 2024). A smart space design modeled with innovative technologies should consider optimization as the main feature of an available automated solution for society.

The design of smart spaces modeled with electronic resources, home automation, and sustainable architecture aims to offer an alternative prototype model that is feasible to implement in constructions with housing scenarios in smart cities. It provides adaptation options for constructions that guarantee better functionalities. La Cruz Chacón (2018) states that a modeled design that adapts to all types of living spaces, requiring greater control and comfort through systems with tools, resources, platforms, automated applications, security, comfort, and ease of use, ensures greater control and management of home functions. On the other hand, it will contribute to solving environmental problems, seeking to fulfill the Sustainable Development Goals and the targets of the 2030 Agenda.

3. METHOD

The methodology employed to conduct the study was descriptive documentary research; where descriptive tables were created to identify electronic resources and elements of home automation engineering, highlighting characteristics and functionalities with specific descriptions. Applied research was also carried out, where schematic designs of connectivity for electronic hardware and software resources were created. These schematics were modeled based on the characteristics analyzed in the descriptive tables and addressing the functionalities of software engineering, in addition to modeling the infrastructure spaces for sustainable architecture.

In Figure 1, the methodological framework detailing the development of the research work is presented, proposing a planned design with home automation engineering and sustainable architecture for habitable spaces in smart cities. This framework is organized into four numbered phases, structuring the methodology as follows:

First Phase: Documentary research and review of references in home automation engineering and sustainable architecture.

Second Phase: Analysis and selection of electronic resources for smart space design.

Third Phase: Design and engineering using intelligent resources for infrastructures with urban planning in smart cities.

Fourth Phase: Development of an automated prototype model for smart homes with a focus on sustainability.

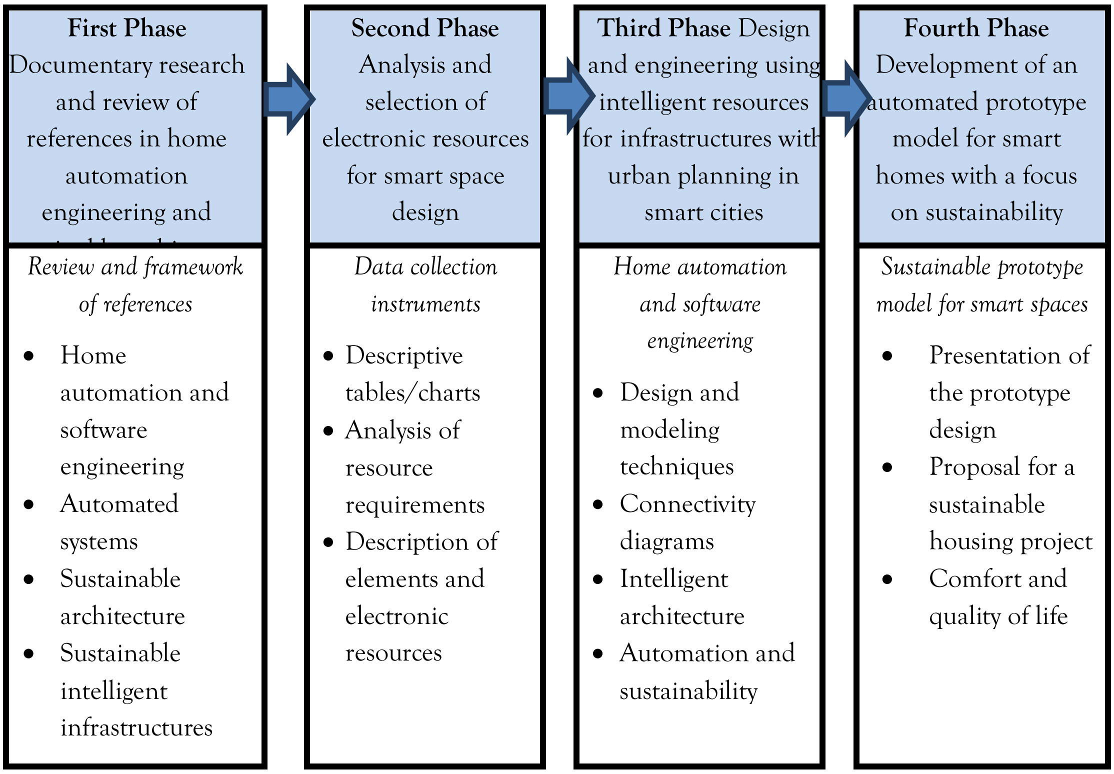

Figure 1: Methodological scheme with a description of the development phases of the study: design and urban planning with home automation engineering and sustainable architecture for habitable spaces in smart cities.

First Phase. Documentary research and references in sustainable home automation engineering

In the initial phase of the study, a systematic review of theoretical and documentary references from various sources was conducted to collect and specifically describe data and relevant information related to home automation and software engineering incorporated into automated and sustainable architectural projects for residential homes. Works on automated systems combining electronic elements and resources with home automation technologies were consulted. Additionally, environmental topics driving sustainable development, such as energy conservation, alternative energies, elements, and factors for designing smart spaces, housing comfort, and quality of life, were explored. This was done to establish a frame of reference with general knowledge regarding the themes that supported the smart space design project with sustainability.

Second Phase. Analysis/selection of electronic resources for smart spaces

The second phase aimed to identify the electronic elements and resources to be used in designs and models with technological innovation for automated and sustainable housing infrastructures. Descriptive tables were designed and applied, indicating characteristics, functionalities, and/or costs of each of the basic resources to be considered in intelligent models for physical infrastructures. Systematic organization with alternatives was carried out in the descriptive tables to facilitate the selection of resources.

An interview instrument was also designed and applied to key informants, knowledgeable about technological developments, sustainable architecture, and environmental issues, to gather opinions and/or suggestions on smart space models with sustainability. Additionally, the feasibility of implementing a prototype model with sustainable architecture for habitable houses, mainly for middle and upper-class individuals, was explored.

Third Phase. Design and engineering with intelligent resources for physical infrastructures

In this third phase, an observational field study was conducted, visiting the space to be modeled—an advisory classroom for projects and activities within the Systems and Computing Department of the Technological Institute of Acapulco. Measurements were taken to adapt the physical spaces based on sustainable architecture, creating preliminary representations of connectivity in the infrastructure. Specific designs were made with diagrams of connectivity for electronic resources, home automation, and software engineering, adhering to references of functional and non-functional requirements. The purpose of this stage was to design and/or model feasible schemes based on connectivity theories, automation, and sustainability of infrastructures, ultimately creating a prototype model designed for habitable spaces.

Fourth Phase. Automated prototype model for smart and sustainable homes

In the fourth and final phase of the study, the presentation of the smart space prototype design took place, where project reports were presented based on model evaluations and deductions generated from information provided by key informants. The presentation of the prototype design, modeled with innovative technological tools, sustainable architecture, home automation, and software for residential infrastructure, addressed environmental conservation. Alternatives were presented with a sustainable development strategy and technological innovation, in addition to emphasizing the comfort and quality of life of individuals. The purpose of this phase is to present the intelligent space design for adoption and implementation, promoting the development of automated projects with sustainability for physical infrastructures, specifically residential houses, strategically addressing the Sustainable Development Goals and fulfilling the targets established in the 2030 agenda.

4. Findings And Discussions

The obtained results allowed for the identification of fundamental electronic elements and resources. Through systematic reviews of references, supported by descriptive tables and charts, documentation and basic knowledge for the design of smart spaces with urban planning in cities promoting sustainability were facilitated. Specifically, the characteristics and functionalities of elements to automate homes or infrastructures that enhance user comfort were analyzed. Kandt and Batty (2021) argue that innovative analytical practices promise smoother decision-making as part of a smarter, evidence-based urbanism, defining a new era that can lead to large-scale research for strategic purposes and proposals on how urban analysis can inform long-term urban policy. Methodological theories were also identified for developing engineering with technological innovation, home automation, and software in the automation of physical infrastructures. These documented insights generated optimal alternatives for selecting resources and elements to use in the arrangement of living spaces, allowing decision-makers to make informed choices based on reliable references by incorporating home automation and sustainable architecture with intelligent systems for user comfort.

Table 1 presents the list of fundamental electronic elements and resources, selected after descriptive analysis, organized according to functionalities, characteristics, advantages, and disadvantages for decision-makers to choose from. The classification presented corresponds to the elements and resources considered for the design of the intelligent space of an automated prototype model for a classroom in the physical infrastructure of the Systems and Computing Department. However, these selected resources could also be considered in the sustainable architecture of residential houses for middle and upper-class users.

On the other hand, the increasing trend of smart homes or Smarthomes is exponential, undoubtedly adjusting to environmental variables and user behavior, seeking numerous qualities with expensive solutions (Mendoza and Marín, 2022).

Table 1:
Systematized description of fundamental electronic elements and resources considered in the design of smart spaces for sustainable and comfortable homes

Resource/element	*Characteristics*	*Functional description*	*Budget*
DOME IP **Camera**. IPC-HDBW2831R-ZS. Number of required resources: 4 	4 Megapixeles, for video h.265+/h.265/h.264+/h.264, lens 2.8mm, viewing angle h: 104° v:55°, IR distance 30m, ETHERNET port rj-45 (10/100base-t), net weight 0.4kg. power supply 12v, dimensions φ109.9mm×81mm (4.33"×3.19").	Smart code technology reduces bit rate and storage. Achieves sharpness. Smart IR adjusts the intensity of infrared LEDs. IVS functions. Compatible with security API. Captures day and night automatically (ICR) / color / b/w.	Mexican Peso $ 9,036.00
NVR IP 5208 Number of required resources: 2 	8-channel IP NVR recorder, 4K / 8MP resolutions, video formats: H.265 / H.264 / MJPEG / MPEG4, two-way audio, bandwidth 320 Mbps, HDMI (4K) and VGA (1080p) video outputs, 4 alarm inputs / 2 alarm outputs.	NVR with H.265 codec, flexible multi-frame structure, and intelligent noise reduction for high-quality video, reduces bit rate and storage by up to 70% compared to standard H.265 video compression.	Mexican Peso $5,858,00
Access Control Resource ASI1212D. Number of required resources: 1	Built-in EM 125kHz proximity reader. Integrated fingerprint reader. Memory for 3000 fingerprint templates. Identification modes: UNIQUE EM 125kHz proximity identifier,	It operates in standalone mode or network mode, allowing access control for a single door or for entry and exit. The controller must be connected to an external access reader from the ASR series or a reader with the interface. Possibility of connecting an external	Mexican Peso $2,415.00

	fingerprint, any combination of these elements. Remote programming from the computer.	ASR reader.	
Magnetic lock 280 Kg Number of required resources: 1 	Magnetic lock / electromagnet, supports a maximum of 600 Lbs / 280 kg. State sensor, door locking LED indicator, anti-residual magnetic design	With the magnetic lock, a home automation access will be created through the security access; this will be programmed to determine who is authorized to enter the premises and subsequently open. Power consumption: 12 VDC, 340mA	Mexican Peso $ 1,398.70
Switch SwitchTP-LINK TL-SG1024D Number of required resources: 2 	Switch TP-link TL-SG1024D 24 RJ45 ports of 10/100/1000m	Interconnection device used to connect networked devices, forming what is known as a Local Area Network (LAN), with technical specifications following the standard known as ETHERNET (or technically IEEE 802.3).	Mexican Peso $ 3,635.54
Alarm and sensor kit ART-ARC2000B-03. Number of required resources: 1 	Wireless Control Alarm, 32 wireless zones (433 MHz). Bidirectional wireless communication up to 150 meters in line of sight. Supports up to 8 remote controls within a range of 80 meters. Connects to the network via 2.4 GHz WiFi, with 4 connections for wireless sirens. Supports configuration through P2P. Fully integrates with HDCVI or IP CCTV.	The alarm and sensor kit will be installed in the NVR port. It can be managed through GDMSS and IDMSS. Dimensions: 118x115x22 mm. Operates with a 5 V DC power source. Preferably wall-mounted. Integration with Dahua cameras. P2P communication.	Mexican Peso $ 1,159.00
Coil of UTP Cable, Category 6. Number of required resources: 2 	Coil ENSON 305 M UTP Cable, Category 6	UTP cable used for connection, useful for telecommunications.	Mexican Peso $ 5,186.00
Tool kit For operational work on-site. Number of required resources: 2 	1 flat precision screwdriver: 2mm, and 1 PH1 precision screwdriver; 12 metric Allen keys: 0.9, 1.2, 1.5, 2, 2.5, 3, 3.5, 4, 4.5, 5, 5.5, and 6mm. 9 six-point metric sockets: 5, 6, 7, 8, 9, 10, 11, 12, and 13mm. 3 Torx bits: T10, T15, and T20; 3 flathead bits: 4mm, 5mm, and 6mm. 3 Phillips bits: PH1, PH2, and PH3.	Tool kit AS PRETUL SET-42 For technical tasks. 2 combination pliers with pointed and cutting tips, 1 multi-purpose knife, 1 level, 1 hammer weighing 226g with a curved claw, 1 multi-purpose scissors, 1 adjustable wrench, 1 handle for bits, 1 3m pro-3meb tape measure, and 1 adapter for sockets.	Mexican Peso $ 1,234.00

***Source:* Own elaboration.**

The review of references through a selected list of devices provides information on all the features offered by the proposed system. This review of compatible devices offers a description of elements and resources that guide the functionality, support for implementation, and maintenance of an automated smart home system for commercial use. It highlights the number of devices comprising the system and the technologies used. Typically, a basic package to automate a small house exceeds $1,000 (Stolojescu-Crisan et al., 2021).

Figure 2 presents the prototype design of smart connectivity, sustainable architecture, and 3D front facade plans for habitable infrastructures. This design is based on modeling techniques from software engineering, home automation, and other innovative technologies. The model of intelligent spaces is represented for a classroom in the educational institution belonging to the Systems and Computing building of the Technological Institute of Acapulco. However, it is also applicable to users' homes requiring comfort and resource optimization by implementing technological tools and/or intelligent systems, as well as spaces built with sustainable architecture and automation.

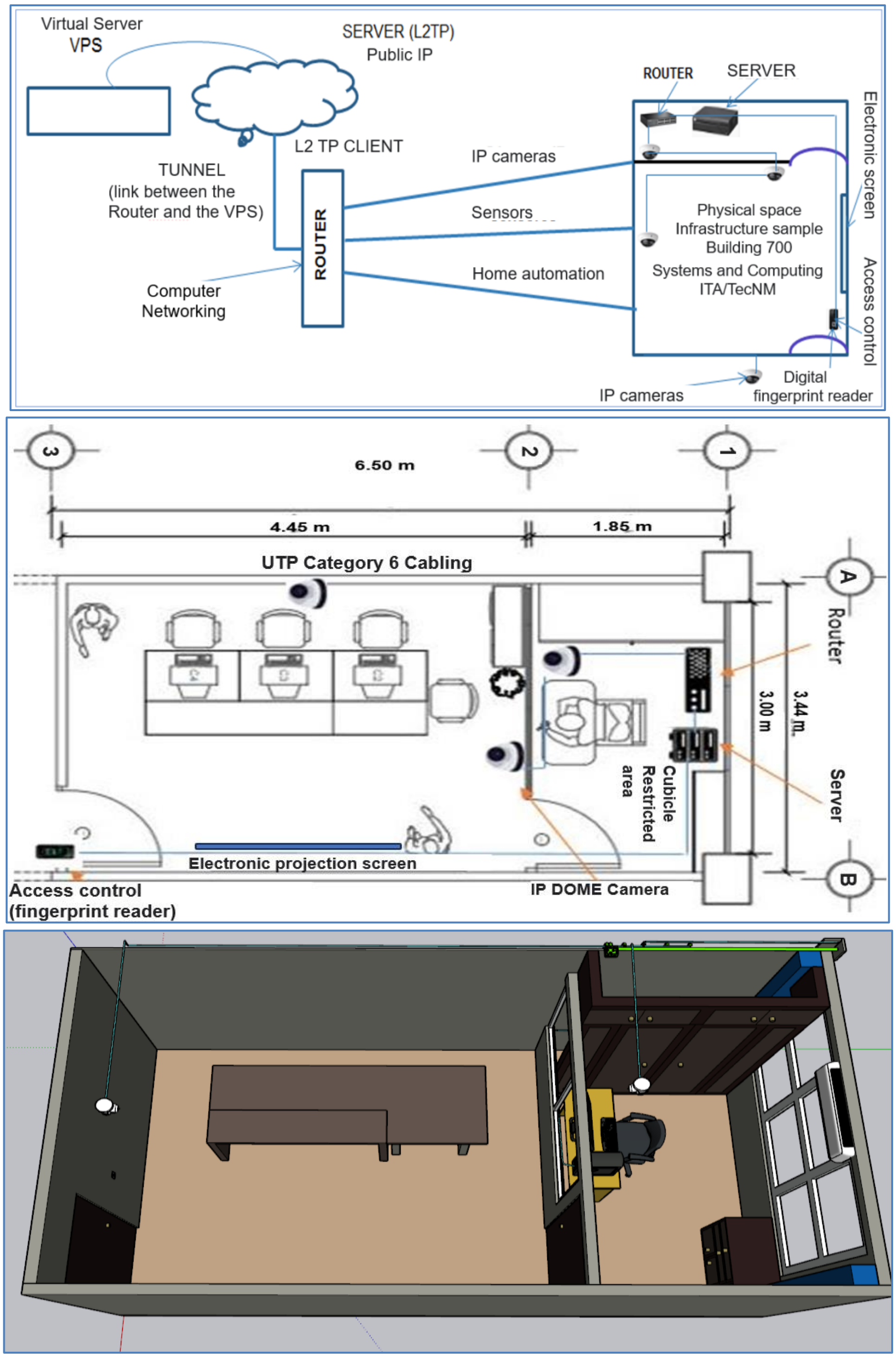

Figure 2: Design of habitable space with intelligent automation, sustainable architecture, and 3D front facade based on home automation and software engineering.

The automatic approach based on software engineering, home automation, and modeling with sustainable architecture allowed generating a design that contributes to environmental conservation and implementing a prototype model for a simulated physical space in a small residential house. This design is feasible for implementation in planned urban housing for smart cities that are geared towards sustainability. This result aligns with the work of Yar et al. (2021), who suggest that automation optimizes energy consumption, designs optimal programming for smart homes, and offers additional benefits such as reducing/eliminating human intervention, saving time, and maximizing the use of natural light when possible. Intelligent engineering design for spaces represents the management and planning of energy systems that promote socially reflective mechanisms in energy development, implying the generation of new avenues to foster cultural and material changes in the structure of contemporary energy systems (Richter et al., 2016). On the other hand, the development of computing and connectivity has a wide range of applications, such as monitoring, detection, and identification, home automation, and industrial and healthcare applications that maximize coverage, optimize lifespan, and energy efficiency with a results-oriented strategy (Priyadarshi et al., 2020).

Figure 3 depicts the city space where the intelligent housing model is profiled to optimize energy consumption, security, and intelligent functionalities for homes. Specifically, the infrastructure is modeled using home automation and sustainable engineering principles.

Figure 3: City and physical infrastructure used for the prototype model design in the Department of Computer Systems Engineering at the National Technological Institute of Mexico, Acapulco campus.

Source: Own photos for research, January 2024.

The automated prototype design for smart homes was presented to experts in sustainable architecture, innovative technological engineering, and environmentalists. Interviews were conducted to gather opinions on the feasibility of implementing the intelligent space design in residential physical infrastructures (Figure 4).

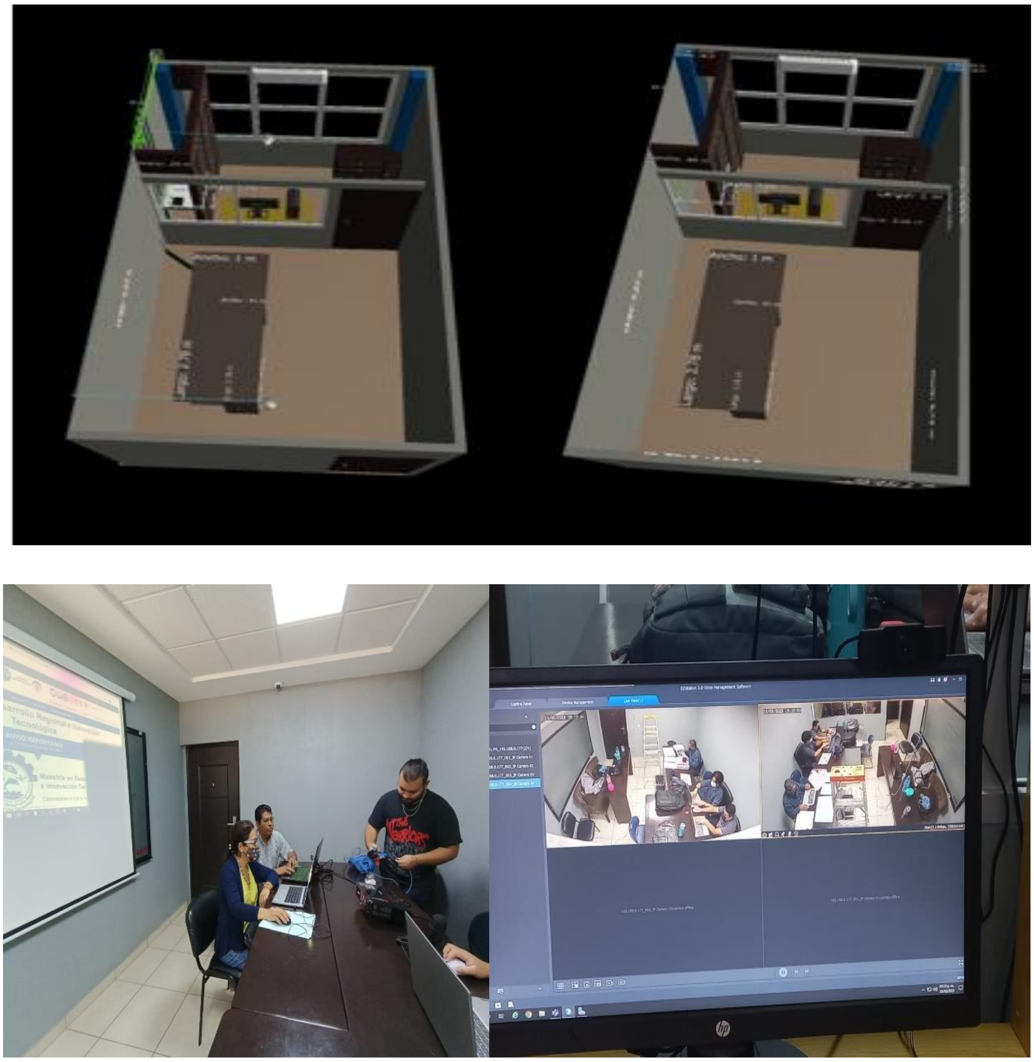

Figure 4: Smart space design with home automation and sustainable architecture presented to key informants in sustainable architecture, innovative technological engineering, and environmentalists at the National Technological Institute of Mexico, Acapulco campus

Source: Own photos taken for the research; January 2024.

The opinions of these informants demonstrated favorable acceptance of the design. They emphasized that innovative technologies should be integrated into all areas, especially in habitable infrastructure, as it is a priority. In addition to implementing intelligent systems and ensuring user comfort, actions for environmental care and sustainability must be promoted and implemented. These deductions align with the statements of Olutosin et al. (2022), who emphasize that smart home automation and its application have progressed significantly toward comfort, convenience, home security, and quality of life improvement.

Smart home systems typically offer significant benefits, including entertainment, energy savings, security, and support in daily activities. However, these intelligent systems still face challenges related to trust, privacy, acceptance, and openness to the use of novel systems in homes (Schomakers et al., 2021).

Considering the call for Sustainable Development Goals and the fulfillment of the 2030 agenda, it is inferred that the implementation of actions and studies related to automation and sustainability in architecture with urban planning is a technological development strategy that contributes to solving real-space challenges. It has broad potential for positive impacts on social, environmental, and economic aspects. The use of ICT is essential in designing a smart city; therefore, intelligent urban design is a proposal that aims to change the management and construction of concepts and methods that modify how we plan and design cities (Alva-Fuentes and Nava-López, 2019). Ultimately, the intelligent planned design proposed by the conducted study can be adapted to defined dimensions, usage, processes, resources, characteristics, decision-making needs, and even to smart homes and cities that adapt planning and design.

5. CONCLUSION

The analysis of the resources and elements considered for the design of intelligent spaces with urban planning allowed understanding the characteristics and functionalities of various elements. They were systematically classified, providing organized alternatives for selecting resources to create diagrams modeling an intelligent and functional space intended for residential homes in smart cities. This analysis, supported by tables and descriptive charts, facilitated the systematization of specific resource information, aiding the researchers in defining and selecting fundamental elements for the intelligent prototype design. As a test resource, an auditorium in the Systems and Computing building at the Technological Institute of Acapulco was utilized, applying home automation and software engineering to primarily direct environmental care strategies, automated innovations, and comfort for spaces with sustainable architecture.

The sustainable development strategies implemented for this applied research project with technological innovation focus on achieving sustainable development goals and targets set in the 2030 agenda. To meet these objectives, it is necessary to manage actions that incorporate sustainable architecture into infrastructures with the support of automation. In this research approach, the automated prototype model with sustainability was developed, designed with home automation and technological innovation for residential homes, aiming to promote sustainable development in smart cities.

Designing intelligent spaces builds confidence to implement a project based on a prototype model with urban planning. Through theoretical and systematic analysis, knowledge of schematic model techniques, resource connectivity integration, and its application in the real social context of residential spaces where people live was generated. In urban infrastructures, automation with innovative technologies should be incorporated as a strategic alternative to contribute to integrated environmental care and sustainability, representing a crucial opportunity in smart cities.

Lastly, the application of interviews designed for and conducted with key informants, experts in innovation, automation, and sustainability, revealed that the development of sustainable automated prototypes is a necessity for current and future society. Prioritizing environmental care actions with the support of innovative technologies in residential spaces will significantly contribute to the sustainability of smart cities. Society is encouraged to responsibly engage in environmental actions with technological innovation and sustainable architecture adopted in living spaces, thereby making a substantial contribution to sustainable development.

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