

Smart Sustainable approach to improve King Faisal Students' University housing interior design and Identity

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Abstract: Environmental Sustainability has become of global importance and trend in interior design and architecture, contributing to providing a safe urban environment at the individual and community level to ensure its continuity for future generations while limiting the depletion of natural resources and minimizing the negative impacts on the environment. Whereas, the vision of the Kingdom of Saudi Arabia 2030 AD, put the environment and sustainable development among its main goals, so that sustainability becomes a way of life that is supported and applied in society with environmental standards that raise the efficiency of energy and water consumption and improve the quality of life. The new identity of King Faisal University looks forward to contributing to achieving environmental sustainability in the Kingdom of Saudi Arabia, which explains the role of higher education institutions in achieving sustainable development and providing a stimulating university environment that keeps pace with technology. The study problem was identified in the main challenges related to the environmental sustainability of King Faisal University represented in the student housing units to reduce the negative impacts on the environment on campus in general and student housing in particular. The study aims to achieve sustainable design as one of the modern trends in architectural thought and interior design of student housing units at King Faisal University and its positive impact on students and their psychological health, Understanding an integral part of society and everything that affects society affects students and the educational process for each student, by finding smart interior design solutions in a new and innovative way that achieves the concept of sustainability and depends on the efficient use of environmental resources, making the university a sustainable and environmentally friendly society. The researcher used the descriptive, analytical and experimental approach by studying the smart interior designs proposed for student housing units and their requirements. The study highlighted the role of sustainable interior design thinking and sustainable environmental materials in achieving the quality of student housing units at King Faisal University as a decisive and necessary step in building a more sustainable future on campus capable of addressing some issues related to the environment.

Keywords: Sustainability, Sustainable Design, Sustainable Architectural Design, Higher Education Institutions, Smart Buildings, Smart Housing Units.

1. Introduction

Sustainability is a lifestyle that attempts to reduce an individual or community's use of the Earth's natural resources and personal resources. Sustainable livelihood practitioners often try to reduce their carbon footprint by changing modes of transportation, energy consumption and diet. Sustainability consists of three pillars of sustainability, economic viability, environmental protection and social justice.

Sustainable design seeks to reduce negative impacts on the environment, health and comfort of building occupants, and thus improve building performance. The primary goals of sustainability are to reduce consumption of non-renewable resources, reduce waste, and create healthy and productive environments.

The Kingdom of Saudi Arabia is a petroleum country, and therefore protecting the environment and maintaining the stability of energy markets are at the heart of sustainable development. One of the main objectives in Vision 2030 is the adoption of ambitious economic plans to diversify the sources of income for the Saudi economy, which is mainly dependent on oil, and for this reason, the inclusion of scenarios for economic diversification with the achievement of joint benefits to mitigate the effects of climate change will achieve a successful strategy for the sustainable development goals in both the economic and environmental sides. Whether.

Where energy efficiency standards will contribute, invest in renewable energy and increase its contribution to the national energy mix, intensify research and development in carbon capture and storage technologies or utilize it in industrial applications and reduce methane gas leakage as part of the sustainability and carbon management program in Saudi Arabia, and also, support Using natural gas and increasing its share in the national energy mix.

The Saudi Vision 2030 is concerned with strengthening the political, developmental and economic position of the Kingdom of Saudi Arabia. The vision has set the environment and sustainable development among its main goals, and stipulates the need to preserve it, primarily as a religious, patriotic and humanitarian duty and a responsibility for future generations, and it is one of the foundations for quality of life and a necessity to reduce pollution levels in the environment.

The Kingdom of Saudi Arabia is a founding member of the United Nations and has played an active role in shaping the outcomes of the Sustainable Development Goals. Over the past five decades, the Kingdom of Saudi Arabia has made remarkable progress on the path of economic and social development. Since then, the Kingdom and the United Nations Development Program have built a strategic partnership for development.

In 2018, the Kingdom of Saudi Arabia presented its first national voluntary review at the High-Level Political Forum held between 9-18 July 2018 at the United Nations Headquarters in New York. More than 1,000 governments, delegations, companies and civil society leaders attended to discuss the progress governments have made towards implementing the SDGs. The theme for 2018 is “Transformation towards sustainable and resilient societies”. Sustainable development emphasizes social progress in developing health, education, agriculture and social development.

The voluntary national review of the Kingdom of Saudi Arabia, with the support of the United Nations Development Program, contained a comprehensive review of the status of the sustainable development goals, its alignment with the Saudi Vision 2030, and the actions taken by national entities including the government, the private sector and NGOs to achieve the 2030 sustainable development agenda

2. Problem Statement

The study problem was identified in the main challenges related to the environmental sustainability of King Faisal University represented in the student housing units to reduce the negative impacts on the environment on campus in general and student housing in particular.

3. Research method

The researcher used analytical and experimental descriptive approach.

4. Questions of the study

- Would the potential use of sustainable interior design in the student housing units?
- reduce the negative impacts on the environment on campus in general and student housing in particular?
- help in designing innovative sustainable living units?
- replace traditional building techniques with smart techniques?
- contribute in improving the quality of life of the occupants of these residential units?
- has a positive impact on students and their mental health?

5. Research Objectives

The study aims to:

- Achieving the environmental sustainability of the Kingdom's 2030 vision.
- Emphasizing the role of the interior designer in developing the traditional living spaces of student housing units into smart housing units with environmental sustainability.
- Making environmental sustainability a priority for higher education institutions represented by King Faisal University.
- Emphasize the use of natural light through windows because of its health benefits.

6. The History of Smart Homes

The first smart homes were ideas, not actual structures. For decades, science fiction has explored the idea of home automation. Prolific writers, such as Ray Bradbury, imagined a future where homes were interactive, and seemingly ran themselves. In Bradbury's cautionary short story, “There Will Come Soft Rains” he describes an automated home that continues to function even after humans have died out. It's all well and frightening, until you consider the actual benefits of home automation, and then the idea becomes more comforting than chilling.

Although the idea of home automation has been around for some time, actual smart homes have only existed a short while. This timeline focuses on hardware; meaning actual inventions leading up to the smart homes we know today and can expect from the near future.

1901 – 1920 - The invention of home appliances – Although home appliances aren't what we'd consider "smart," they were an incredible achievement in the early twentieth century. These achievements began with the first engine-powered vacuum cleaner in 1901. A more practical electricity-powered vacuum was invented in 1907. Throughout two decades refrigerators would be invented, as well as clothes dryers, washing machines, irons, toasters, and so much more.

1966 – 1967 - ECHO IV and the Kitchen Computer – Although it was never commercially sold, the ECHO IV was the first smart device. This clever device could compute shopping lists, control the home's temperature and turn appliances on and off. The Kitchen Computer, developed a year later, could store recipes, but had the unfortunate tagline, "If she can only cook as well as Honeywell can computer" and therefore sold no models.

1991- Gerontechnology combines gerontology and technology and makes the lives of senior citizens easier. In the 1990s, there was a lot of new research and technology in this sector.

1998 – Early 2000s: Smart Homes – Smart homes, or home automation, began to increase in popularity in the early 2000s. As such, different technology began to emerge. Smart homes suddenly became a more affordable option, and therefore a viable technology for consumers. Domestic technologies, home networking, and other gadgets began to appear on store shelves.

Today's Smart Homes - Today's smart homes are more about security and living greener. Our smart homes are sustainable, and they help to ensure that our homes aren't expending unnecessary energy. They also help alert us to intruders (whether we're home or not).

Current trends in home automation include remote mobile control, automated lights, automated thermostat adjustment, scheduling appliances, mobile/email/text notifications, and remote video surveillance.

Sustainability Definition

Means enduring into the long-term future, it refers to systems and processes that are able to operate and persist on their own over long periods of time. The adjective "sustainable" mean able to continue without interruption or able to endure without failing. The word "sustainability" comes from the Latin verb *sustinere* "to maintain, sustain, support, endure, made from the roots *sub*. It is an environmental term that describes how ecosystems remain diverse and productive over time. In addition, sustainability for humans is the ability to preserve the quality of life we live in the long term, which in turn depends on the conservation of the natural world and the responsible use of natural resources.

Sustainability means that a process or state can be preserved at a certain level as long as it is a development that "meets the needs of the present without compromising the ability of future generations to meet their own needs." Sustainability is important for many reasons including: Environmental quality - in order to have healthy communities, we need clean air, natural resources and a non-toxic environment. Health care - sustainability and healthcare are intricately linked because the quality of our environment affects public health.

The Three Pillars of Sustainability

The principles of sustainability are the foundations of what this concept represents. Therefore, sustainability is made up of three pillars: the economy, society, and the environment. The three pillars of sustainability are a powerful tool for defining the complete sustainability problem. This consists of at least the economic, social, and environmental pillars. If anyone pillar is weak then the system as a whole is unsustainable.

- Economic Development.
- Social Development.
- Environmental Protection.

Sustainable architectural design

Sustainable design or sustainable architecture is a school of thought that focuses on creating buildings that are environmentally sustainable, aiming to reduce the building's negative effects on the environment by using environmentally friendly materials and achieving energy efficiency. In addition to promoting the health of the building's occupants. which can be implemented through all areas of design that start from construction and end with product design, with the use of nature's resources without harming the environment, and make them balanced while taking into account future generations and living in a high level of health and well-being.

A sustainable university

It is an educational institution that educates students for sustainable development, provides insights related to pressing societal challenges, minimizes the environmental, economic, social and health impacts of campus operations, enables students and staff to work, and makes sustainability a central priority. The concept of a sustainable university must also include environmental protection, economic performance and social cohesion.

A sustainable university consists of five aspects as follows

- Education:** aims to educate students for sustainable development.
- Research:** Discover answers to societal questions.
- Processes:** Zero footprint for campus operations.
- Society:** Empowering students and employees to work on sustainability.
- Governance:** Make sustainability a priority for the educational institution.

What are the main features of a sustainable campus?

“A sustainable campus is a space in which the community can learn and gradually develop a culture of sustainability and stewardship of natural resources” Whether working to reduce our ecological footprint, raise awareness about environmental problems or research sustainable solutions, educational institutions that are working to transform themselves as agents of change are living and learning institutions for sustainability. The concept of “sustainable campus” is an aspiration, a vision that nourishes our practice. Each educational institution, unique in its history and culture, can create its own path of sustainability.

- Access to public resources.
- Urban renewal procedures.
- Reducing carbon dioxide emissions.
- Preference for ethical consumption.
- Reduce, reuse and recycle.

How to Promote Sustainability on our College Campus?

1. Set Up Recycling Stations Around Campus.
2. Plan an E-Waste Recycling Drive.
3. Start a Bike Rental Program.
4. Visit Sustainability Summits.
5. Tour Renewable Energy Plants and Sustainable Buildings.
6. Start a Campus Community Garden.
7. Adopt Long-Term Campus Sustainability Goals.








Definition of sustainable housing

The 1987 Brundtland report defined sustainable development as having three elements: economic, environmental, and social.¹ Since then the term sustainable has been attached to every imaginable aspect of human activity. In many cases it is simply intended to promote one activity or product against others. But beyond that there is a real problem with a three dimensional term: that some imbalance between the three elements is inevitable. The UK Government’s *Sustainable Communities Plan* lists twelve requirements of a sustainable community: one is economic (a flourishing local economy), seven are social (strong leadership, effective participation, a mix of homes, basic amenities, good quality public services, vibrant local culture, ‘sense of place’) and four are environmental (buildings that meet different needs over time and that minimize the use of resources, safe and healthy environment).






Sustainable environmental materials

Sustainable materials are materials used throughout our consumer and industrial economy which can be produced in desired volumes without depleting non-renewable resources and without disrupting the steady state balance of the environment and major natural resource systems.

Table 1. Green Building Materials

No.	Green Building Materials	Description	Figure
1	Straw Bales	Straw is a sustainable, renewable, natural material locally available at reasonable prices, in addition to the use of straw bales in building walls of homes to replace other building materials such as concrete, wood, gypsum, fiberglass or stone. It also provides high levels of thermal insulation warm or cold climate.	
2	Translucent Concrete	is a concrete based building material with light-transmissivity properties due to embedded light optical elements usually optical fibers. Light is conducted through the stone from one end to the other.	
3	Hemp Crete	It is a concrete-like material constructed from the inner wood fibers of the hemp plant.as a rapidly growing renewable resource and created in the form of concrete-like shapes that are very strong and lightweight which can reduce the energy used to transport the blocks.	
4	Bamboo	Bamboo material has been considered a local building material for thousands of years, in addition to being a building material suitable for modern buildings due to its strength, light weight and renewable nature. It can be an alternative to expensive or heavy-weight imported materials and is an alternative to building concrete and steel reinforcement, as it is used in reconstruction after disasters and is suitable for low income levels in construction due to its availability as a local natural material.	
5	Recycled Plastic	Recycled plastics are used by researchers in creating concrete with lower weight and less greenhouse gas emissions, in addition to providing a new use for plastic waste.	
6	high-density polyethylene (HDPE)	High-density polyethylene is 100% recyclable, and its advantages are that it is naturally resistant to bacteria and rust and does not produce VOC emission. It can be used in bathroom partitions and lockers. can also help your facility to earn points toward Leadership in Energy and Environmental Design (LEED) certification. ¹	
7	Sustainable Wooden	Sustainable Wooden is used as they suit the new architecture that is more environmentally friendly, sustainable and made from fibrous sugar cane waste and the raw materials used in these panels are 100% recyclable, compostable and	

¹ <https://www.scrantonproducts.com/what-is-sustainable-design-in-architecture/>

		biodegradable. In addition, wood is considered a material with less environmental impact in its production and life cycle	
8	Mycelium	Mycelium is a futuristic building material that's actually totally natural – it comprises the root structure of fungi and mushrooms. Mycelium can be encouraged to grow around a composite of other natural materials, like ground up straw, in forms, then air-dried to create lightweight and strong bricks or other shapes.	
9	Ferrock	Ferrock is a new material being researched that uses recycled materials including steel dust from the steel industry to create a concrete-like building material that is even stronger than concrete. What's more, this unique material actually absorbs and traps carbon dioxide as part of its drying and hardening process – making it not only less CO2 intensive than traditional concrete, but actually carbon neutral.	
10	AshCrete	AshCrete is a concrete alternative that uses fly ash instead of traditional cement. By using fly ash, a by-product of burning coal, 97 percent of traditional components in concrete can be replaced with recycled material.	
11	TimberCrete	Timbercrete is an interesting building material made of sawdust and concrete mixed together. Since it is lighter than concrete, it reduces transportation emissions, and the sawdust both reuses a waste product and replaces some of the energy-intensive components of traditional concrete. Timbercrete can be formed into traditional shapes such as blocks, bricks, and pavers.	

7. Smart Buildings

Not every smart building is a smart home. Commercial, industrial and residential institutions and buildings of all shapes and sizes including offices, skyscrapers, apartment buildings, offices and multi-tenant residences - are deploying IOT technologies to improve building efficiency, reduce energy costs, lighting, heating, air conditioning, environmental impact, and ensuring security. For example, a smart building can reduce energy costs by using sensors that detect the number of students in a room. It can also set the temperature automatically, turn on the cold air or lower the temperature if students come home from university. It is one of the main application areas of binding technologies for embedded systems and the Internet of Things. These systems must be adaptable and flexible in order to provide better services to their residents.

8. Smart Materials

Smart materials technologies are most significant in 21st-century. "Smart Materials" shall have a crucial role in construction technology. These innovative materials constitute an important part of smart building systems that shall be capable to detect its surrounding, so that the smart materials behave similar to living systems. The design of smart materials involves highly integrated components and requires interdisciplinary knowledge. Smart materials, are capable of adapting to their exterior surrounding.

9. Smart Residential Units

A smart home is a residence that uses internet-connected devices to enable the remote monitoring and management, A smart home is a home that has highly sophisticated automated systems to control and monitor any home function; Lighting, temperature control, multimedia, security, window and door operations, air quality, or any other task of necessity or comfort performed by a home resident. With the rise of wireless computing, remote-controlled devices have become smart in time. Today, it is possible to install a programmed chip on any passenger and have the systems adapt to the person's passage through and through the smart home.

The smart home allows students to remotely control parts of the housing unit and create schedules for smart devices that support the unit through wireless or wired systems. Using a smartphone or tablet device with an internet connection. To help control cost saving and be more energy efficient while saving more convenience and time.

A smart home appears "smart" because its computer systems can monitor many aspects of daily life. For example, your refrigerator may be able to inventory its contents, suggest menus and shopping lists, recommend healthy alternatives, and even routinely order groceries.

10.Smart housing systems

Smart housing unit systems have become more widespread and demanded by people, as modern technology has helped provide smart home security systems that help control everything in the home in addition to these systems being environmentally friendly and time-saving that improve safety and help achieve comfort. Smart at this time is a necessity with the possibility of its use and application not only for the affluent and the affluent, and given that home security systems help in obtaining a safer environment by monitoring private cameras remotely and controlling other devices at home through the phone via the Internet.

Smart housing units are more effective in terms of energy savings as smart home systems allow devices to work efficiently without using much energy, which reduces electricity bills by automatically turning off lights when rooms are not occupied.

Advantages of smart residential units:

The smart housing units are considered in the current era, where technological advancements have helped the occupants of these units to design their residential units according to their unique styles and needs.

In addition, the smart housing units provide the following:

- **Comfort:** where convenience is the first feature that is considered through the automation of the housing unit for all unit technologies in one interface, and you need to know how to use the application to fully benefit from the smart housing unit. In addition, these units accept more devices or functions and can be installed smoothly.

- **Safety:** One of the capabilities of the smart housing unit is to achieve security and surveillance, as there are many options available for more security through automatic locks that can be controlled in or outside the residential unit, which can make sure that the door is closed or not. Surveillance cameras and alarm devices can be added against Any security problems, install a smart doorbell that enables it to inform unit occupants who is standing at the door, thus increasing the security levels of the smart housing unit.

- **Energy Efficiency:** Precision controls of the smart housing unit help to achieve more energy efficiency through smart home appliances that save energy, and the control devices of the residential unit help to achieve more accuracy in the use of heating and air systems.

Today's smart home technologies are attracting more and more people who value convenience and modern technology solutions. However, it should be noted that arranging a smart home is a serious step and the result depends on how well the preparation for selection, installation and commissioning of all systems is done.

-The design of the smart home system begins with the design of the building or apartment.

-Create a conceptual design that describes all the tasks that the smart system will perform.

-The design of smart home control is created based on the needs of the occupants of the space, as the response to each request is a device that performs a specific task, and the combination of these devices is the vicinity of the smart home.

-There are networks to collect data and networks to distribute orders where they receive data from sensors and then give operating orders.

Disadvantages of smart housing units

While a smart home provides convenience and cost savings, there are still challenges. Security risks and errors continue to engulf the tech makers and users. For example, savvy hackers can access internet-enabled home appliances in the smart home. In October 2016, a robot called Mirai penetrated interconnected devices from digital video recorders, cameras, and routers to shoot down a group of key sites through a denial of service attack. Measures to mitigate the risk of such attacks include protecting devices and smart devices with a strong password, using encryption when available and only connecting trusted devices to one's network. The costs of installing smart technology can range anywhere from a few thousand dollars for a wireless system to tens of thousands of dollars for a wired system. It is a heavy price to pay, especially since there can be a steep learning curve to get used to order for everyone in the family.

11. Smart housing technologies

- **Lighting control:** Intelligent lighting control can reduce the accumulation of switches on the wall, and it is possible to control all lights in the room to reach ideal lighting. In addition, it can control the amount of natural light in the rooms by controlling the shades of the windows so that they rise or fall to control the amount of light. It can also be turned off automatically if the room is empty, and it works when any movement occurs, and the intensity of lighting can be controlled according to the user's desire or automatically according to daylight.

Control of heating, ventilation and air conditioning, so that the user can remotely control home temperatures.




-**Security and protection:** Through smart door, locks according to standards set by the user, so that the doors open automatically in the event that the residents of the house approach or open by entering the password through a screen located at the doors.


Smart systems help to detect dangerous gas leakages and detect fires using smoke detectors and communicate with the competent authorities to ensure a timely response.

Smart TVs allow connection to the Internet to access content through installed applications such as video and music, and some smart TVs can implement what the user requests by voice recognition.

-**Energy Management:** The smart system saves energy consumption and reduces cost for the user. In addition provide the user with a great deal of convenience and efficiency, as it is possible, for example, to set the smart coffee maker and make a new cup as soon as the user's morning alert goes off, and the system can automatically open and close the curtains within specified times and smart refrigerators can track expiration dates, create shopping lists and create recipes On the basis of the ingredients present in it currently.

Table 2. Smart Products that can be used in Smart Sustainable Housing Units.

N o.	Smart products	Description	Figure
1	Smart thermostats	Smart thermostats are characterized by saving money up to 23% annually on heating and cooling costs. It works to achieve balanced temperatures throughout the housing unit.	
2	Smart Electronic locks	Smart electronic locks are used to stabilize the home security system, safety and peace of mind. It improves the protection of the home security system. Almost everyone has a smart phone locks have began to incorporate smart technology with the Internet of Things..	
3	Light bulbs connected via Bluetooth	Connection to Smartphone via Bluetooth Built in Bluetooth speaker.	

4	Smart home appliances	Smart home appliances are specialized equipment programmed to run from a central system. Any domestic device can be a smart appliance, and though they are not cheap, many times, they can be leased instead of bought in order to cut down on the price.	
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12.A proposed experimental student-housing unit towards environmental sustainability: Project Description:

The proposed design of a student-housing unit at King Faisal University towards university environmental sustainability is designed for one or one female student and designed according to the functional internal needs of the occupants of the student-housing unit as shown in Fig. 1. &2. The interior design of the unit depends on smart internal systems in the design process, in addition to achieving the internal design thinking based on sustainable environmental materials for the quality of student housing units on campus. The approximate total area of the floor plan of the proposed student-housing unit is approximately 42 square meters as shown in Fig. 3, the outer and inner walls of which are constructed of Translucent Concrete.

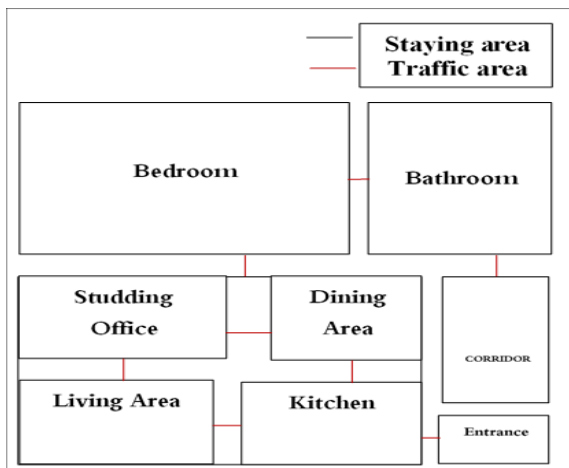


Fig.1.Design Zoning.

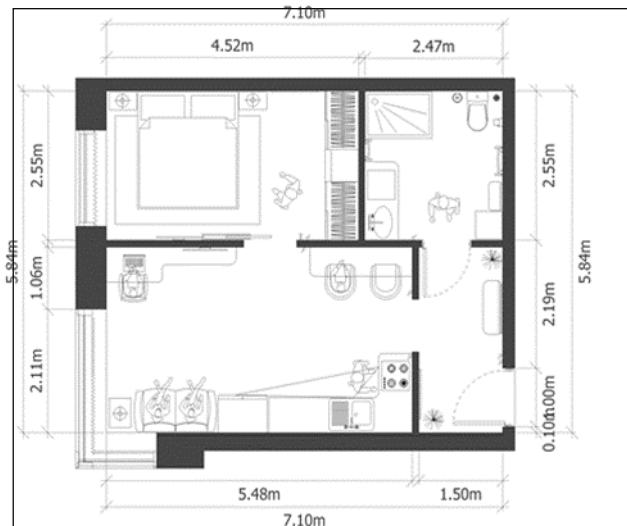
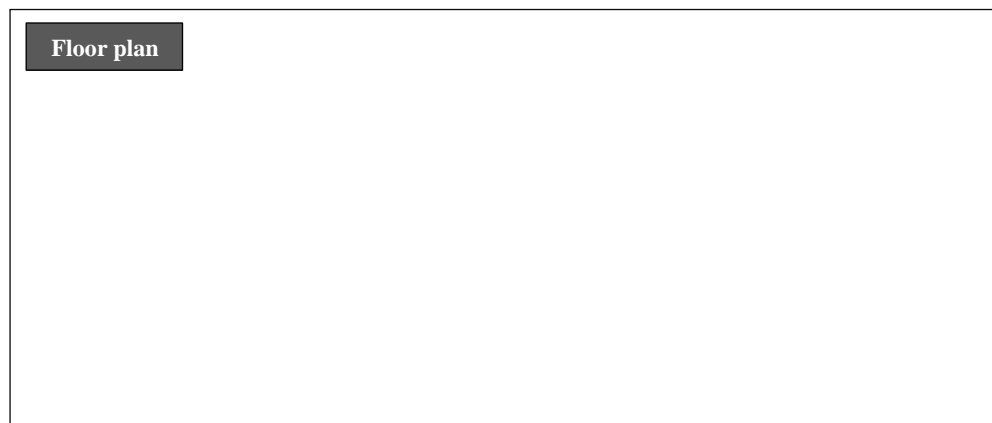


Fig.2. The floor plan of the proposed housing unit



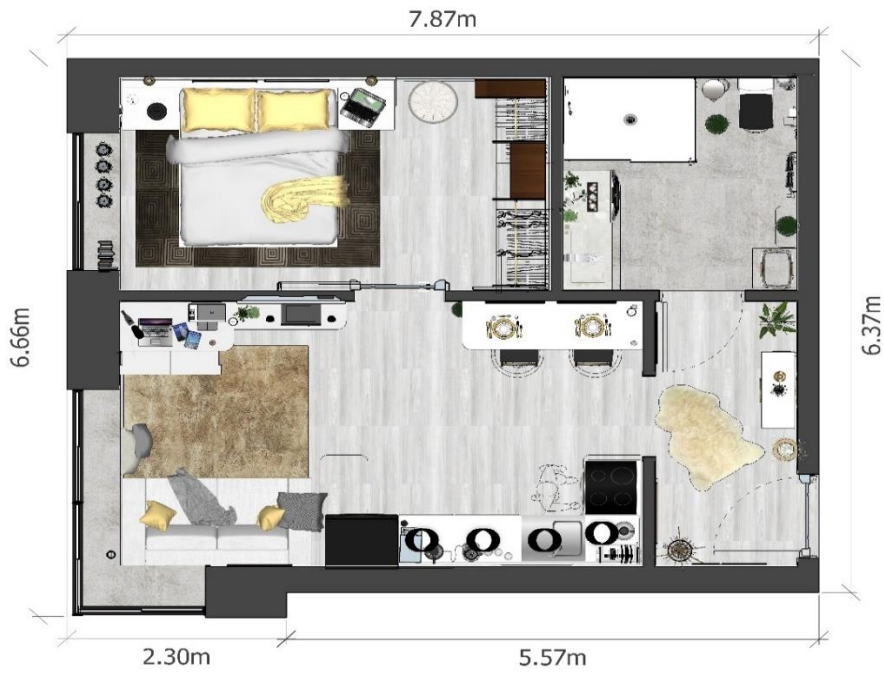
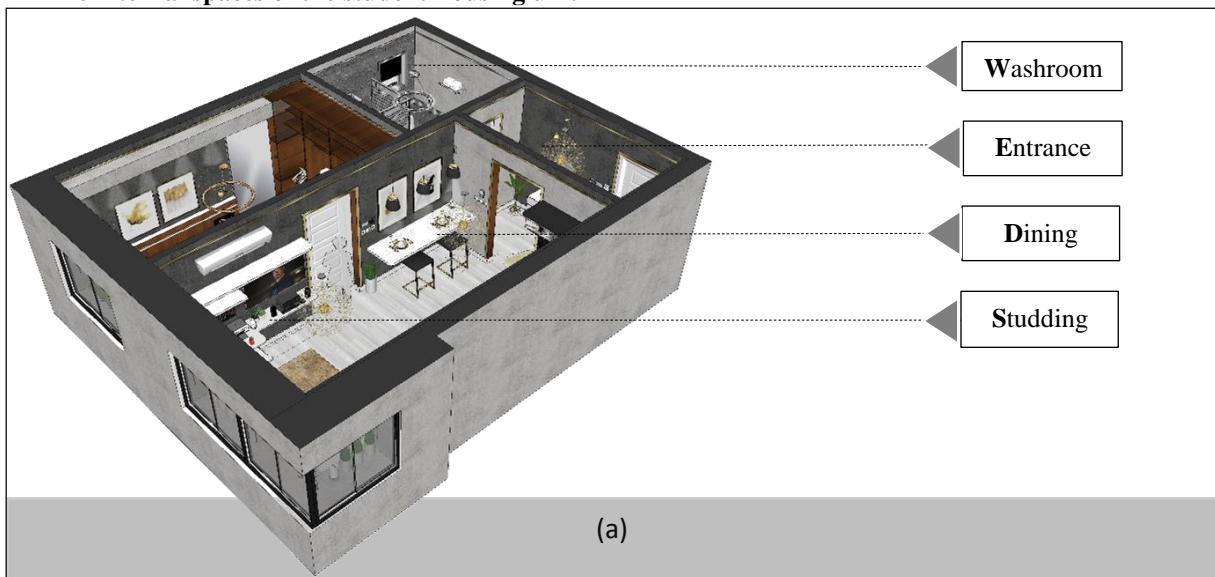


Fig.3. The floor plan of the residential unit, explaining the layout of the furniture and the integration between the architectural and interior spaces.

The internal spaces of the student-housing unit



(a)

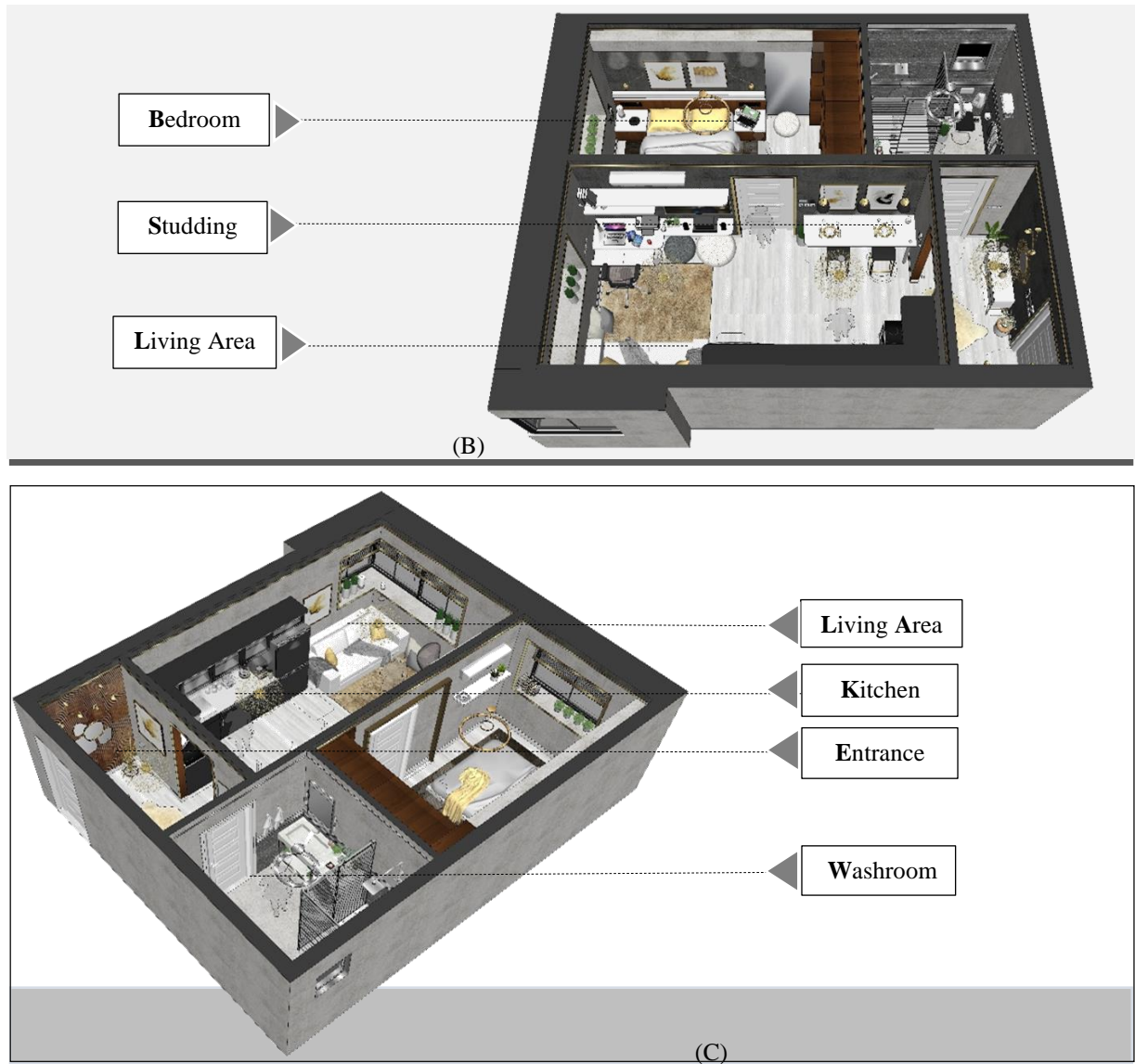


Fig.4. (a) (b) (c) Perspectives for the interior spaces of the proposed sustainable student-housing unit.
The internal perspectives of the design proposed housing unit



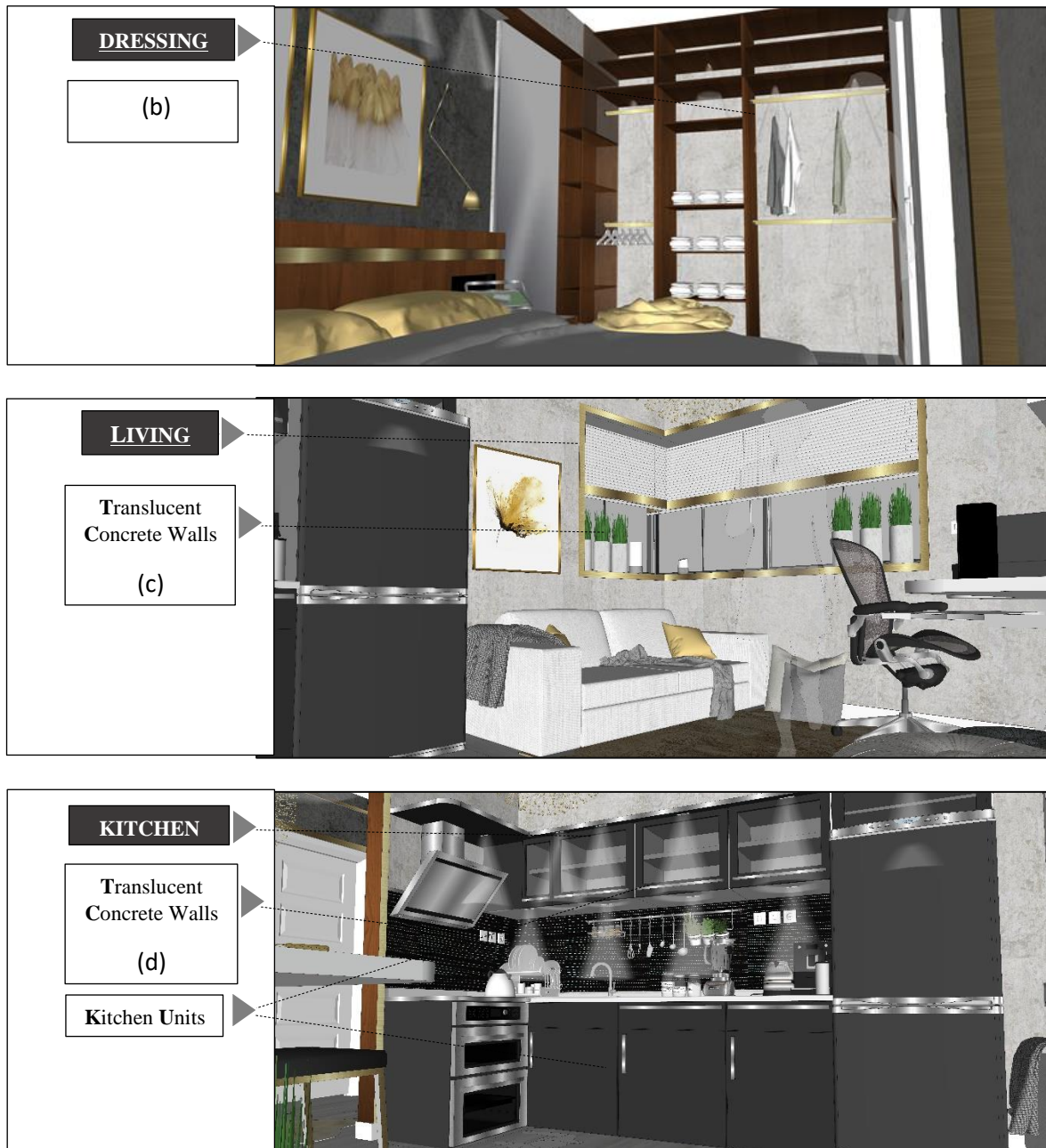


Fig.5. (a) (b) Internal perspectives of bed room, & (c) (d) Internal perspectives of living area and kitchen of the proposed sustainable student-housing unit.

Internal perspectives of the dining room - the kitchen - the reception - the bathroom





Fig.6. Internal perspectives the different functional spaces of the sustainable student-housing unit (a) (b)Internal perspectives of Dining - kitchen & (c) perspective of Entrance & (d) perspective of Bathroom

13.Sustainable Design Concept for the student-housing unit

Sustainable development is one of the challenges of the twenty-first century, and the improvement of the interior spaces of residential units depends on the air we breathe. Technology has an essential role to play in achieving sustainable design. The trend towards sustainable living also has an impact on the materials and methods used to recreate interior spaces. People can control the lighting condition from their phones, set automatic timers for bedroom lights, and even control natural light by opening the curtains at certain times. The LED lights are easily integrated with solar panels to provide energy efficient lighting both day and night. Where increased energy savings are the main drivers for smart residential units.

Smart interior design

The smart interior design of the residential unit is based on the integration of creative and technical solutions with smart materials, furniture and sensors to control all functions and communicate through the Internet and mobile smart phone applications that are able to quickly respond to students' requirements to provide comfort, safety and a productive environment to enhance students' lives. as shown in Fig. 5.The smart interior design is

characterized by its ability to provide and analyze data related to the performance of the vacuum and reveal the deficiencies and errors in the design systems, which contributes to rationalizing the consumption of resources and reducing costs. Among the features of smart interior design are: Integration by linking interior design components with smart systems, which contributes to enhancing performance. The ability to easily adapt to changes within the housing unit. Connecting the design to communication networks and the Internet, which helped facilitate and efficient communications. Interdependence with building systems and the ability to study design and provide a perception about student behavior within the housing unit, in addition to the use of smart materials and smart lighting to improve energy.

Application of Translucent concrete to exterior walls and interior walls

Translucent concrete is a new technology that differs from regular concrete. It allows more light and is considered less weight compared to traditional concrete. It uses a sunlight source instead of using electrical energy, in order to reduce the load on non-renewable sources. Concrete also represents a new form of building material, which is a mixture of concrete and optical fiberglass as it is called lightweight concrete that allows natural or industrial light to pass through the concrete blocks naturally according to its color. As a sustainable building material, it can be used in interior design and furniture in a functional and aesthetically innovative way as shown in Fig. 6.

Advantages of applying Translucent concrete in building the outer and inner walls of the student-housing unit

- Lowest carbon emission as it is a sustainable environmentally raw material.
- It is a material that protects from fires and is characterized by its high resistance to ultraviolet rays.

It has the distinction of having a good aesthetic view of the external building or employing it in the interior design of the residential unit. The technical development of these materials helped transform concrete from gray concrete blocks into luminous concrete walls that achieved the aesthetic and functional side while preserving the material's properties in terms of strength and durability as shown in Fig. 7.

It is distinguished by that the control of the pattern of light passing through the transparent concrete is due to the glass fibers used in its components.

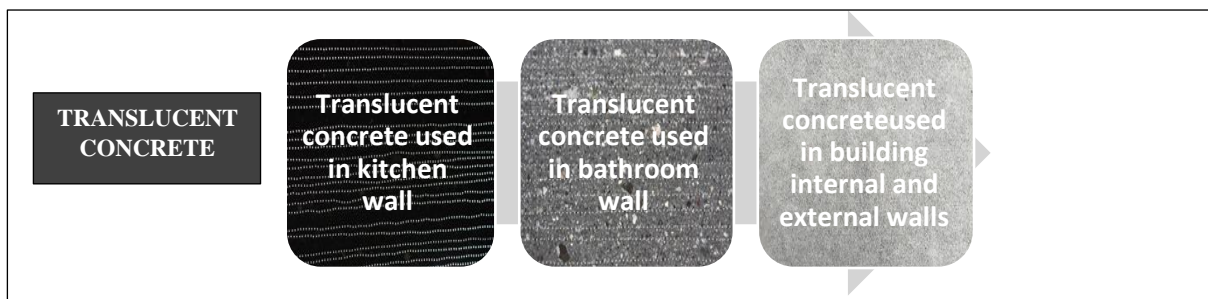


Fig.7. The different texture of the transparent concrete that were applied inside the student-housing unit.

Sustainable Wooden Walls

Environmentally friendly sustainable architecture is one that takes into consideration the use of natural resources, the environmental impact and risks, in order to preserve the safety of people. 3D wood wall panels were used as they suit the new architecture that is more environmentally friendly, sustainable and made from fibrous sugar cane waste and the raw materials used in these panels are 100% recyclable, compostable and biodegradable as shown in Fig. 8. In addition, wood is considered a material with less environmental impact in its production and life cycle.



Fig. 8. The different textures of the sustainable wooden walls that were used within the student-housing unit.

Architecture and interior design are subject to constant change in line with the twenty-first century due to the technological development in design and construction and its impact on interior design, represented by the development of the concept of smart residential units and their access to environmentally sustainable designs. The interior design of the proposed student residence is based on smart technology that combines energy efficiency and absolute control.

Smart kitchen

The smart kitchen is designed for a sustainable student residence so that modern technologies are applied in the kitchen to add to the value of the housing unit and achieve comfort and safety. The use of smart devices in the kitchen, such as smart refrigerators, that monitor expiration dates on food and send messages to remind you to use food while it is still fresh, and this information is available through the device itself and this is done through the smartphone application. The settings of the smart oven can also be monitored and controlled through smart applications, as these ovens can preheat, cook and even turn off when the food is ready. In addition to Smart kitchens, digitally monitor cabinet contents and order alternatives. as shown in Fig. 5.(d) Home screens support hands-free operation of home appliances in the kitchen for smart devices through voice activation technology as voice commands.

Living room

The living space is designed as a seating unit that fits two person in addition to being transformed into a bed when you need to sleep and facing the sofa as shown in Fig. 9, a study office, with a small library attached, and a TV screen installed on the wall.

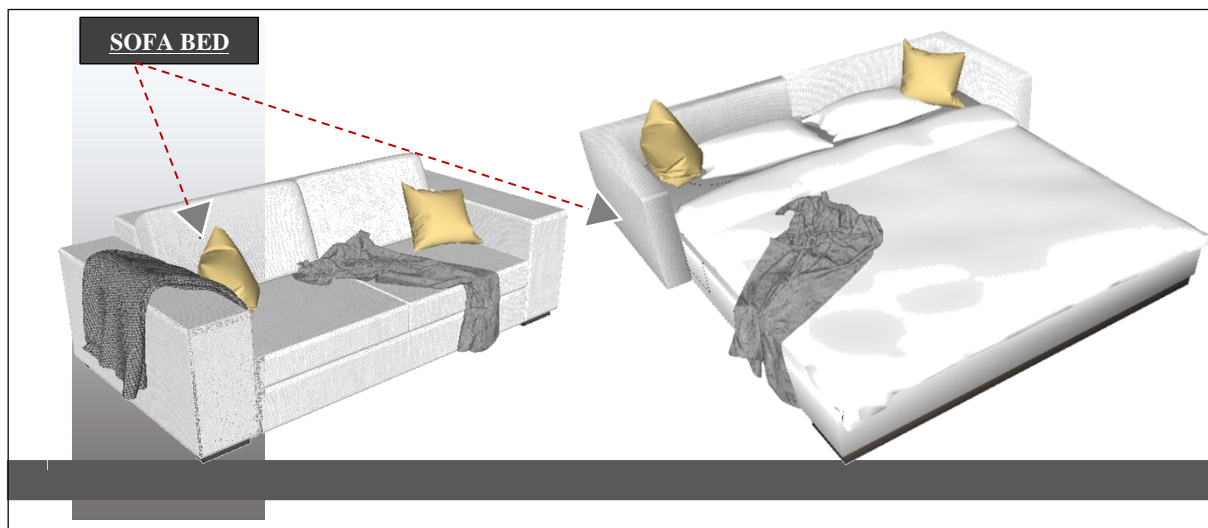


Fig. 9. The use of a sofa bed in the living space fits functionally with the available space

Smart Lighting

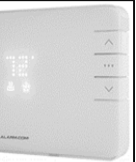
These include smart bulbs like LIFX, Philips Hue, and Kasa (TP-Link). But these aren't just limited to bulbs. Some people buy or build LED light strips and strings to add accents around the house and to spice up holiday lighting displays.





Smart switches: These in some ways, are an alter-native to smart lights. They allow you to remotely control and automate your existing lights by making the light switches smart. Lutron, Kasa, and Wemo are popular smart switch brands. Some smart switches can also be used with dimmable lighting.

Smart locks: Smart locks automate door locks like deadbolts. Yale, Schlage, August, and Kwikset make popular models that allow you to open your door without a key and remotely check and lock your door for security.

14.Interior Design of Student Housing Unit that uses Smart Technology

Table 3. Smart products that can be used in smart sustainable housing units

No.	Smart products	Description	Figure
1	ADT Branded Smart Z-Wave Thermostat	The smart thermostat has a simple and elegant design, and by using sensors in all areas of the housing unit, it is now possible to set the temperature in any room. Temperature Sensors can manage the temperature in any room, Temperature presets can be made with a convenient, energy-efficient, intelligently connected schedule. One integrated mobile app makes the Alarm.com Smart Thermostat part of a seamless Smart Home experience as temperature regulation inside and outside the home can be controlled by responding automatically reduce energy costs. .	

2	Google home	The Google Home app helps you set up and control Google Nest, Google Home, and Chromecast devices. You can control thousands of compatible lights, cameras, speakers and more, all from a single app, as well as see your reminders and recent notifications.	
3	Smart Control Box	The smart grid controller for domestic devices is a control box, which allows regular domestic devices to be started 'automatically' by an active demand control system. This way the devices can be turned on when this suits the (smart) grid the best, but always within the comfort zone of the household.	
4	Digital Smart Locker	A smart lock is an electronic and mechanical locking device that opens wirelessly with an authorized users' authentication. ... Once received, these encrypted digital keys allow access to the smart lock for a preset period.	
5	Smart Lamp	A smart phone to change the light's brightness or colors may control a bedside or desk smart lamp. Looks just like XIAOMI smart lump.	

15. Results and Discussion

Smart Sustainable housing unit Provides comfort and a healthy environment while increasing the ability to control the internal environment through temperature and humidity to create an environment that suits the occupants of the housing unit and is stimulating for it.

-The incorporation of smart design methods has resulted in reduced construction and maintenance costs as well as reduced energy and environmental impact.

-The smart housing unit provides the ability to update electronic systems and equipment without replacement.

-Environmental Sustainability led to achieve energy efficiency and the quality of the internal environment for student housing units.

-The use of building materials that reduce the size of the emission of harmful greenhouse gases in achieving sustainable development.

-Smart materials technologies are most significant in 21st-century in Interior Design.

-Smart interior design techniques such as high efficient and adaptable furniture. led to save spaces. And may be a viable solution in student housing units.

- Helping to increase students' creativity, innovation and creativity through the internal systems of these smart housing units that work to achieve an integrated integration between internal design treatments and use effectiveness.

-The sustainable interior design of the student housing units led to a positive impact on students and their mental health, which helped to have a good compatibility with themselves and their environment.

-The development concrete is critical to advance sustainability, durability of 21st century.

-The Internet of Things will become fully integrated into residential spaces to improve user efficiency, reduce energy use, stop food waste, and track water use.

16. Conclusion

- Promote good environmental practices in the field of sustainable development.
- Developing smart construction materials is therefore important, not just as a research challenge, but also for the role such materials will play in future construction.
- The necessity for researchers and materials scientists to explore ways to design sustainable building materials to reduce their environmental impact.
- Development of new (construction) materials for sustainable building.
- Development of smart materials used in the interior design of residential units.
- Promote Sustainability on Campus.
- Urging interior architecture designers to use new technologies and smarter methods to reduce energy use and reduce emissions.
- The necessity to take into three main axes of consideration: sustainability, technology and efficiency because of their impact on changing the interior designs of residential spaces.

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