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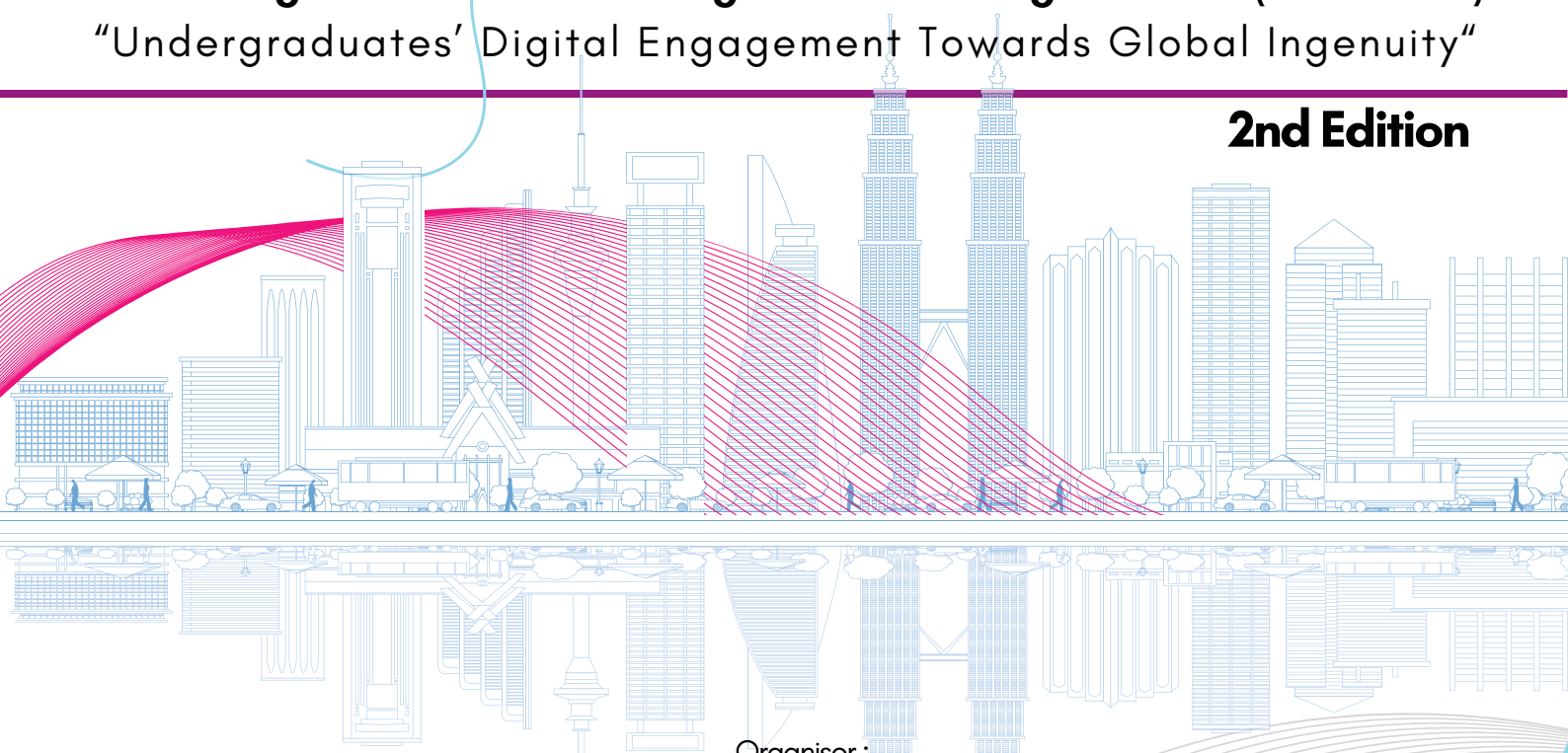
Proceeding for International Undergraduates Get Together 2024 (IUGeT 2024)

"Undergraduates' Digital Engagement Towards Global Ingenuity"

2nd Edition



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INNOVATIVE INTEGRATION OF SUSTAINABLE URBAN DEVELOPMENT FOR BUNGALOW HOMES IN MERU, IPOH

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Abstract
Vista Heaven, a high-end luxury project consisting of 22 bungalows located in Meru, Ipoh, is raising the bar for sustainable living. This project meets the need for high-end residences by incorporating energy-saving elements like smart plugs, LED lights, cool roof materials, solar panels, and rainwater collection systems. These technologies play a role in creating an EcoSmart Sanctuary, highlighting energy efficiency, water conservation, and sustainability as key components. Although facing obstacles such as expensive initial investments, upkeep, and changing user behaviours, Vista Heaven provides important lessons for policymakers, developers, and consumers. It emphasises the possibility of combining luxury living with eco-friendly practices, showcasing the need for ongoing research, policy backing, and education to encourage sustainability in housing areas. Vista Heaven serves as a template for tackling climate change by promoting projects that prioritise both human well-being and environmental health, demonstrating that sustainable living is feasible and attractive.

Keywords: *Energy-Efficient Features, Sustainability, Renewable Energy*

1. INTRODUCTION

Vista Heaven, an upscale project with 22 bungalows in the up-and-coming suburb of Meru, Ipoh, is a notable move towards sustainable urban development as it caters to the demand for high-end housing. This initiative combines cutting-edge green and smart technologies to create an EcoSmart Sanctuary, emphasising sustainability and modern living. Photovoltaic solar panels, smart home systems, cool roofs, reflective window coatings, Low-E glass, and rainwater harvesting systems are all incorporated for renewable power, energy efficiency, and water conservation. These technologies have significantly enhanced energy efficiency, with solar panels satisfying 60-70% of energy needs, LED lighting cutting energy usage by 80%, and rainwater harvesting meeting approximately 30% of non-potable water requirements. Even with obstacles like expensive start-up expenses, upkeep needs, and acceptance by users, Vista Heaven showcases environmentally-friendly high-end living and shows how sustainable materials and smart technologies can boost energy efficiency, water preservation, and overall sustainability in residential development.

2. MATERIALS AND METHODS

The approach of the study includes assessing energy efficiency, water conservation, sustainable materials performance, and smart home technologies in a bungalow. To evaluate energy efficiency, PV solar panels were mounted on the rooftop and their energy production was monitored for 12 months through an online system to determine the proportion of energy demands fulfilled by solar energy. Conventional incandescent light bulbs were swapped out for energy-saving LED lights, with power consumption being monitored before and after the change using a

smart meter. To conserve water, a rainwater collection system with gutters, downspouts, and storage tanks was set up to collect rainwater. Over 12 months, the amount of rainwater gathered for non-drinking purposes was measured, and the efficiency of the system was determined by comparing this amount to the total non-potable water requirements of the household.

Incorporated in smart home technologies is a unified home automation system for managing lighting, heating, cooling, and water usage, along with monitoring energy and water consumption in real-time. Intelligent sensors were installed around the house to track environmental factors like temperature, humidity, and water flow, using live data to enhance resource efficiency and conduct preventive maintenance and adjustments. The research also recorded the initial expenses of installing solar panels and home automation systems, monitored the upkeep needs of intelligent systems, and collected user responses to evaluate the ease of adjusting to new technologies. This thorough approach ensures clarity and replicability, allowing others to duplicate or expand on the discoveries for future research and advancement in sustainable housing practices.

3. RESULTS AND DISCUSSION

The results of this study emphasise the significant advantages of incorporating renewable energy sources, energy-efficient technologies, and smart home systems in homes. Installing photovoltaic solar panels decreased dependence on the grid by supplying 60-70% of the bungalows' energy demands, showcasing the efficiency of renewable energy. Swapping out incandescent bulbs for LED fixtures led to an 80% decrease in lighting energy usage, demonstrating the substantial efficiency improvements possible with contemporary lighting technology. Moreover, the rainwater collection system managed to capture and use around 30% of the household's non-drinkable water needs for watering plants and flushing toilets, demonstrating its effectiveness in decreasing reliance on city water.

The interconnected smart home system facilitated smooth management and tracking of energy and water consumption, improving ease and effectiveness through the ability to remotely modify settings and enhance resource utilisation. Immediate information from intelligent sensors enables preemptive maintenance and modifications, enhancing resource efficiency by identifying and fixing issues like leaks or excessive energy usage. Although there have been successes, challenges such as the costs of setup and maintenance of intelligent systems, as well as users adapting to them, have been recognised. Dealing with these challenges by utilising affordable remedies, educating users, and providing continuous support will be pivotal for wider implementation of sustainable methods. Decreasing the initial expenses of solar panels and smart home systems with subsidies or financing choices, in addition to offering thorough training and assistance for users, can improve the ease of transitioning to new technologies and guarantee lasting advantages. This study demonstrates how integrating sustainable materials and smart technologies into bungalow design can significantly enhance energy efficiency, water conservation, and overall sustainability, emphasising the potential of these innovations to benefit environmentally friendly and cost-effective residential development.

4. COMPONENTS

Smart plug and smart lighting

In the current era of advanced technology and sustainability, various innovative components are essential for enhancing energy efficiency, convenience, and environmental conservation. Smart plugs and intelligent lighting systems play a vital role in this ecosystem. Smart plugs allow users to remotely control electrical devices using smartphone apps or voice commands, enabling them to manage power status, create automated schedules for turning devices on and off, and track energy usage, ultimately providing convenience and energy savings.

Similarly, intelligent lighting systems, which utilise LED bulbs, switches, and fixtures, enable remote and automated lighting control. These systems offer energy-saving options with customisable color and brightness, as well as additional features such as time- or occupancy-based scheduling. Together, smart plugs and smart lighting systems contribute to a more efficient, automated, and eco-friendly home environment. Figure 1 illustrates an image of a smart plug and Figure 2 shows a figure in smart lighting.

Figure 1. Smart plug.

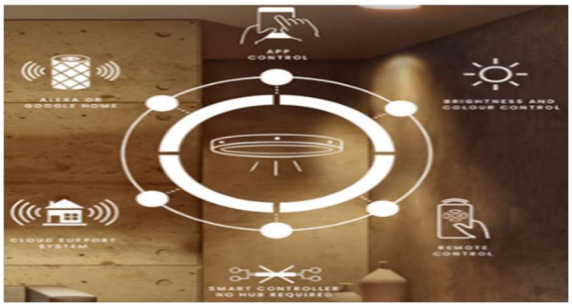

Figure 2. Smart lighting.

Solar panels and cool roof materials

Solar panels and cool roof materials play a crucial role in improving energy efficiency and sustainability in buildings. Solar panels transform sunlight into electricity, offering a sustainable and environmentally friendly energy source that diminishes reliance on traditional power systems, cuts down on electricity costs, and lessens the environmental impact. Moreover, solar panels frequently meet the requirements for tax credits and rebates, which increases their financial appeal. Meanwhile, cool roof materials are created to reflect a greater amount of sunlight and take in less heat compared to conventional roofing. This helps lower indoor temperatures and lessen the reliance on air conditioning, ultimately decreasing cooling expenses. These materials help reduce the urban heat island effect and prolong the roof's lifespan by reducing thermal expansion and contraction. Collectively, these technologies greatly enhance energy efficiency, sustainability, and comfort in both residential and commercial buildings. Figure 3 illustrates an image of cool roof materials.

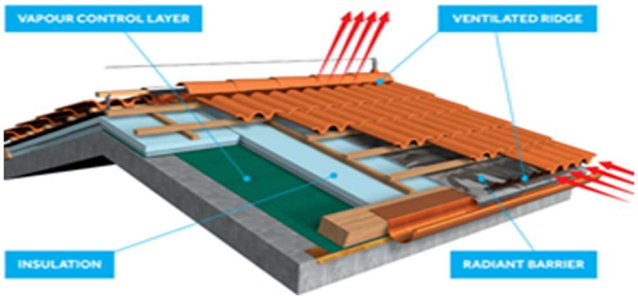

Figure 3. Cool roof materials.

Reflective window films and Low-E glass

Reflective window films and Low-E glass are crucial for improving energy efficiency in buildings with advanced window technology. Reflective films decrease indoor glare and heat by reflecting sunlight, resulting in notable energy savings and enhanced comfort. They also provide protection from UV rays and additional privacy during the day. In the meantime, Low-E glass contains a thin layer that reflects heat and permits visible light, decreasing heat loss during winter and heat absorption during summer.

The use of this material can help to maintain consistent indoor temperatures. Additionally, it can block UV rays and reduce condensation. When used together, these technologies can enhance energy efficiency, comfort, and durability in buildings, highlighting their importance in sustainable architecture. Figure 4 presents images of reflective window films, while Figure 5 illustrates how Low-E glass functions in maintaining consistent indoor temperatures.

Figure 4. Reflective window films.

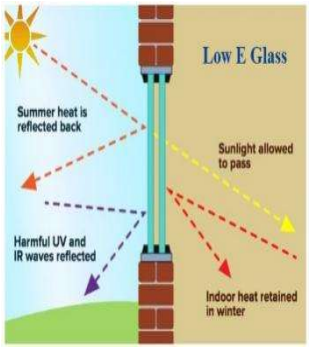

Figure 5. Low-E glass.

Rainwater harvesting

Water preservation is a vital part of sustainable living, and rainwater collection systems offer a practical solution. These systems gather and save rainwater for various purposes such as watering plants, flushing toilets, and producing drinking water with proper treatment. Rainwater harvesting systems contribute to water conservation and reduce water bills by decreasing reliance on municipal water supplies. They provide a sustainable water supply, guaranteeing water access during drought or restrictions, and promote environmental friendliness by utilising natural resources. Figure 6 exemplifies the process of rainwater harvesting.

Figure 6. Rainwater harvesting.

5. CONCLUSION

The study shows that incorporating renewable energy sources, energy-efficient technologies, and smart home systems in residential buildings provides substantial advantages. Photovoltaic solar panels fulfill 60-70% of energy requirements, while transitioning to LED lights decreases energy consumption by 80%. Rainwater harvesting met approximately 30% of non-potable water needs, while smart home systems enhance convenience and efficiency through remote control and real-time monitoring. Despite these achievements, challenges such as high initial costs, maintenance requirements, and user adaptation have been identified. Dealing with these issues by offering subsidies, financing options, educating users, and providing continuous support is essential for increasing widespread usage. The results indicate that integrating sustainable materials and smart technologies in bungalow architecture can greatly improve energy efficiency, water conservation, and sustainability overall. Future endeavours should concentrate on enhancing the accessibility of these technologies in order to encourage eco-friendly and economical residential growth.

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7. REFERENCES

Alessandrini, A., Site, P. D., & Filippi, F. (2023). A new planning paradigm for urban sustainability. *Transportation Research Procedia*, *69*, 203–210. https://doi.org/10.1016/j.trpro.2023.02.163

Jiang, F., Ma, L., Broyd, T., Li, J., Jia, J., & Luo, H. (2023). Systematic framework for sustainable urban road alignment planning. *Transportation Research Part D: Transport and Environment*, *120*. https://doi.org/10.1016/j.trd.2023.103796

Liu, X., & Xia, H. (2023). Networking and sustainable development of urban spatial planning: Influence of rail transit. *Sustainable Cities and Society*, *99*. https://doi.org/10.1016/j.scs.2023.104865

Zhong, Y., & Li, Y. (2024). Statistical Evaluation of Sustainable Urban Planning: Integrating Renewable Energy Sources, Energy-Efficient Buildings, and Climate Resilience Measures. *Sustainable Cities and Society*, *101*. https://doi.org/10.1016/j.scs.2023.105160

Zulkeffeli, Z., & Mui'zz Morhalim, A. (2022). *Thematic Report | THEMATIC REPORT*.

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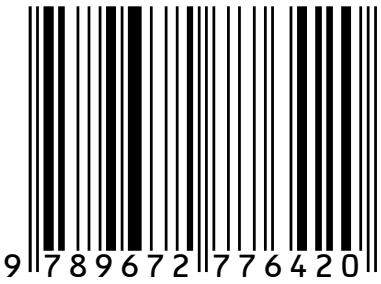

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