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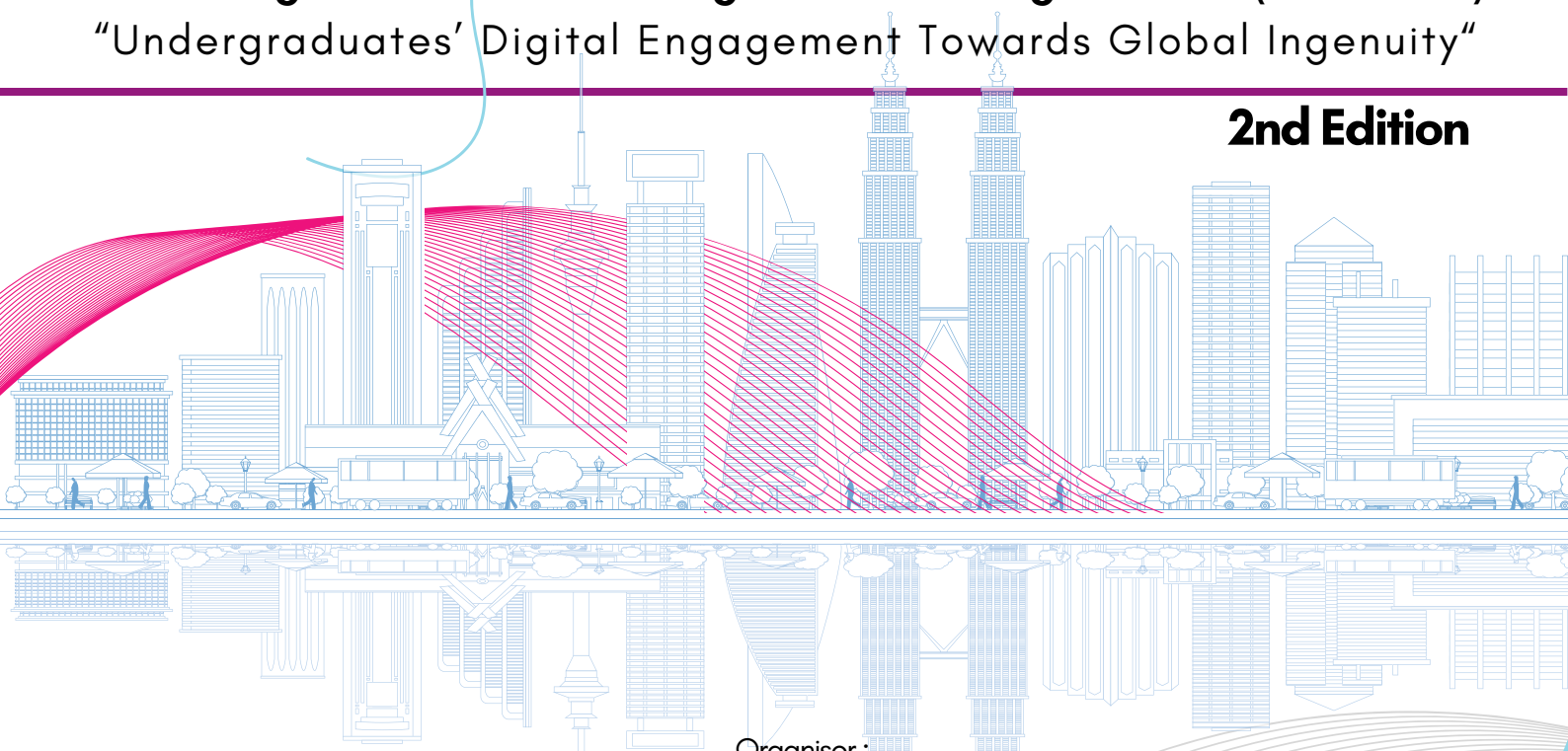
"Undergraduates' Digital Engagement Towards Global Ingenuity"

2nd Edition



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INTERLOCKING FRAME WINDOW

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Abstract
Interlocking frame windows are a new type of frame window structure that provides a comprehensive and efficient way to handle both practical and aesthetic concerns, making them an essential option in the construction industry. This paper explores the innovative features and benefits of interlocking frame windows with a primary emphasis on their joint aspects, discussing their potential applications in the construction industry and their transformative impact on both functionality and design. This study proposes an innovative idea for the construction industry, especially for the Industrialised Building System (IBS). This paper aims to highlight the critical issue statements related to window framing, illuminating the challenges architects, builders, and homeowners encounter in achieving practical and pleasing window frames. This research uses statistical methods and data-driven techniques to help identify potential design changes, address customer pain points, optimise performance, and encourage innovation in interlocked frame windows to meet changing consumer demands and industry standards. The results highlight the usefulness of interlocked frame windows, showing their ability to significantly increase occupant comfort, aesthetics, and overall building performance. This research explores the innovative features and benefits of frame windows, primarily emphasising their joint aspects. It discusses their potential applications in the construction industry and their transformative impact on functionality and design.

Keywords: *Interlocking frame windows, Joint aspects, Construction industry, Industrialised Building System (IBS), Innovation in design*

1. INTRODUCTION

This study investigates the types of interlocking frame windows used in the Industrialised Building System (IBS), encompassing various topics such as the current state of IBS in Malaysia, the application of technology in the building industry, and the global increase in the use of frame windows, while focusing on past, present, and future systems related to jointing and material procedures, aiming to propose an innovation for the construction industry, particularly for IBS, with research objectives that include identifying the main problems and complications faced by current frame windows, proposing an innovation to improve window installation, and assessing the marketability of the innovative product in response to customer demand. Window framing is essential in building design and construction since it serves several functions such as structural stability and aesthetics. When it comes to window framing, however, various issues and concerns develop, affecting the functionality, durability, and overall performance of windows.

This report aims to explain the primary issue statements related to window framing, illuminating the challenges architects, builders, and homeowners encounter in achieving practical and pleasing window frames. The issues and effects of poor installation skills are the focus of the problem statement for jointing frame windows at a wall, with a particular emphasis on lousy craftsmanship.

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Inadequate craftsmanship during the jointing process might result in unstable structures and the possibility of failure because of misalignment or insufficient anchoring. Operationally, it can lead to problems like worsened frame window performance, air leaks, or more friction, which undermines the desired effectiveness.

The problem statement becomes even more complicated when aesthetic integration is considered. Frame profiles, colour selections, and customisation options are examples of design aspects that must harmoniously complement the wall materials and align with the architectural concept. It is difficult for designers and architects to integrate jointing frame windows into various architectural styles in an aesthetically pleasing and functionally sound way. The issue statement also mentions maintenance considerations. To minimise water infiltration and avoid potential damage, the joints between the wall and frame windows should be built in a way that minimises the need for frequent repair. The long-term performance of jointing frame windows depends on their durability, and resolving maintenance issues guarantees an affordable and long-lasting solution.

2. LITERATURE REVIEW

The construction industry relies heavily on window frames to hold glazing and anchor windows into buildings, significantly impacting durability and insulation. Window frames can be made from various materials, including aluminium, wood, fibreglass, and vinyl, each offering unique advantages and drawbacks. Aluminium frames are strong, lightweight, and low-maintenance, but less energy-efficient unless equipped with thermal breaks. Wood frames are aesthetically pleasing and environmentally friendly but require regular maintenance. Fibreglass and composite frames combine strength and energy efficiency but are costlier, while vinyl frames are affordable, durable, and energy-efficient. Common issues in frame window installation include poor workmanship, leading to leaks and reduced durability. Innovations like interlocking mechanisms, advanced adhesive processes, and integrated installation methods aim to improve performance, durability, and installation efficiency, addressing previous limitations and enhancing frame windows' overall functionality and sustainability.

3. METHODOLOGY

This innovation assesses the performance and user experience of interlocking frame windows in residential settings, focusing on their thermal insulation and structural integrity compared to traditional designs. Residential buildings will be randomly assigned to either an experimental group with interlocking frame windows or a control group with conventional windows. The aim is to provide insights for optimising durability and functionality in residential structures. Based on the innovation framework's steps, the research process starts with identifying the problem and moves through ideation, concept selection, and simulation using SketchUp software. Ideation involves formulating and communicating ideas, focusing on structural integration to ensure durability and stability. The study will evaluate the feasibility and corporate value of materials like wood, uPVC, and aluminium, considering security factors such as robust locking mechanisms, aesthetic design, usability, weather resistance, and lifecycle costs. Simulations will create virtual models to test frame window performance under different conditions, improving and optimising the design. Despite enhanced structural stability and security, the commercialisation of interlocking frame windows introduces a durable, aesthetically pleasing, and functional solution for residential and commercial spaces, appealing to architects, developers, and homeowners looking for innovative building solutions.

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4. RESULT AND DISCUSSION

Overall, several differences between standard and interlocking frames have been observed. Five features, weather resistance, durability, ease of installation, aesthetic appeal, and market price, are compared to bring out the differences. A comparison of the two types of frame windows is presented in Table 1. In comparison to the current frame window, the suggested interlocking frame window stands out for its advanced installation, increased durability, improved weather resistance, and more versatile and user-friendly design

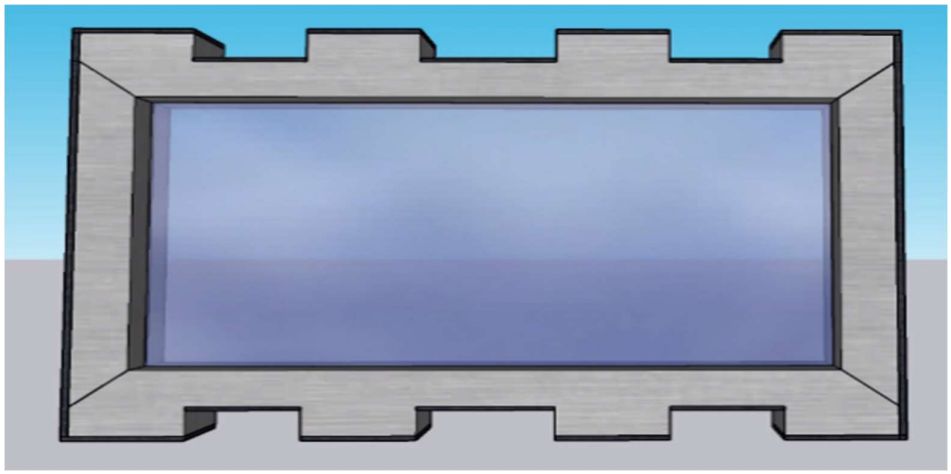

Figure 1. Interlocking frame window

Table 1. Comparison of the frame window

Feature	Interlocking Frame Window	Standard Frame Window
Weather Resistance	Superior weather sealing through tight interlocking joints, reducing air infiltration and water penetration.	Standard weatherstripping with less advanced interlocking features potentially leads to lower weather resistance.
Durability	High durability with interlocking solid components, contributing to the overall strength and longevity of the frame window.	It is durable but may be more prone to wear and tear over time, especially in extreme weather conditions.
Ease of Installation	It is a more straightforward installation process with fewer interlocking features, potentially making it more straightforward for installers.	Installation may require more precision due to the complexity of interlocking components but can offer a tight fit if done correctly.
Aesthetic Appeal	It is aesthetically pleasing with the potential for smooth, modern designs due to the versatility of interlocking features.	Aesthetic appeal is often more traditional, with fewer design options.
Market Price	They are more budget-friendly, making them a common choice for cost-conscious consumers.	They are priced higher due to advanced aesthetics, high durability, and customisation options.

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4.1 Marketability of Interlocking Frame Window

4.1.1 Sustainability and Environmental Awareness

In modern construction, using sustainable practices to reduce environmental impact is crucial. One eco-friendly initiative is using recycled materials, like rubber, in interlocking frame windows. This shows a commitment to responsible resource use and makes these windows more marketable. By appealing to eco-conscious consumers and fitting with the trend of prioritising sustainability, these windows contribute to greener construction practices.

4.1.2 Durability and Longevity

Interlocking frame windows are a durable and long-lasting option for homeowners. Made from solid and resilient materials, they resist wear and tear, warping, cracking, and fading. This robust construction ensures a long lifespan, reducing the need for frequent maintenance or replacement saving homeowners money and effort.

4.1.3 Aesthetic Appeal

Interlocking frame windows combine style and practicality, offering a modern and elegant design. Their clean lines and minimalist look enhance any home's visual appeal. Made from materials like aluminium or composite, they fit well with various design trends, providing homeowners with a stylish and aesthetically pleasing option.

5. CONCLUSION

In conclusion, the innovative interlocking frame window advances architectural design by addressing installation and leakage challenges. Precise coordination ensures functionality, durability, and structural integrity, while effective sealing creates a weather-resistant environment. This window enhances performance and resilience by optimising design, construction, and materials, making it a cornerstone of sustainable building design.

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