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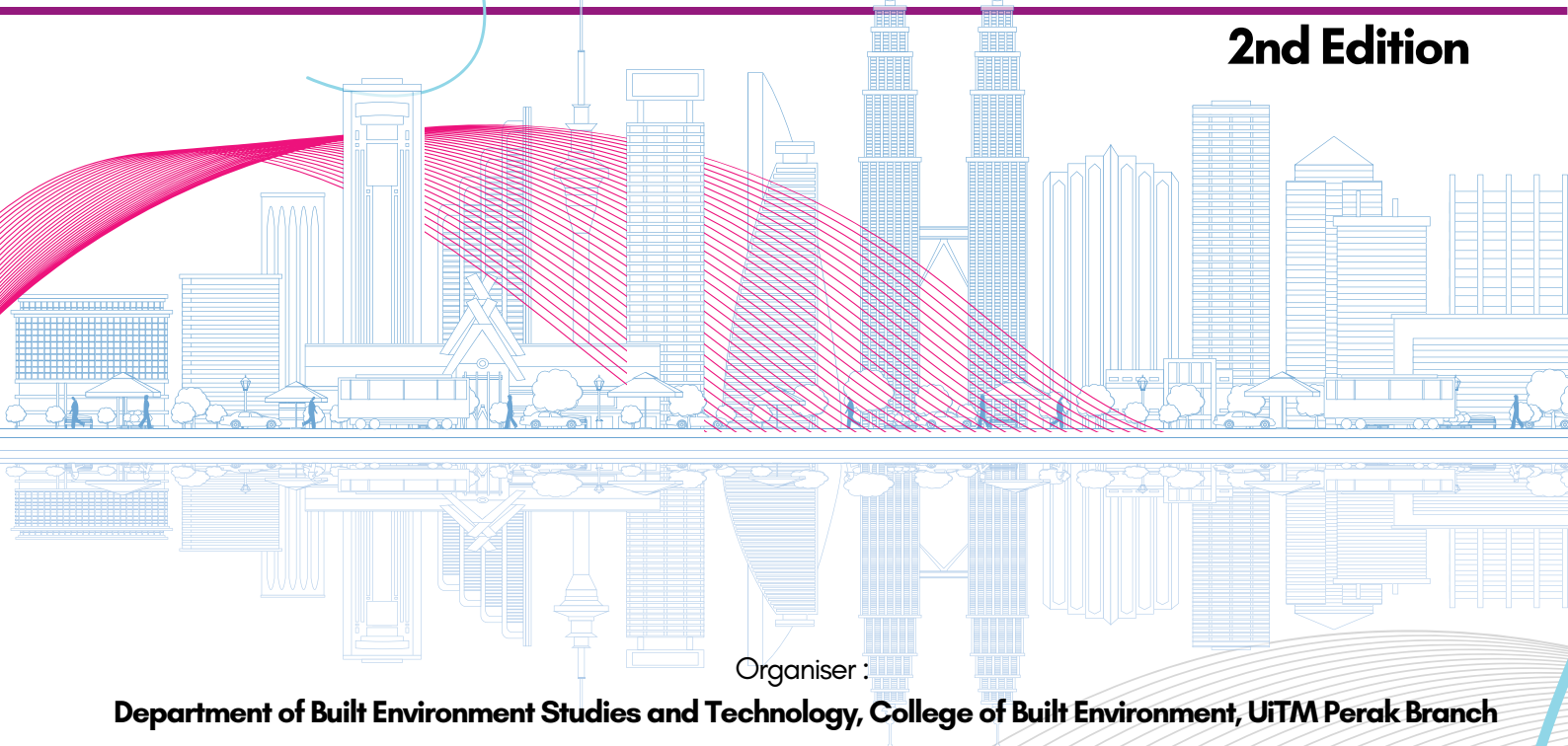
Cawangan Perak

e - Proceedings



Proceeding for International Undergraduates Get Together 2024 (IUGeT 2024)
"Undergraduates' Digital Engagement Towards Global Ingenuity"

2nd Edition



Organiser :

Department of Built Environment Studies and Technology, College of Built Environment, UiTM Perak Branch

Co-organiser :

INSPIRED 2024. Office of Research, Industrial Linkages, Community & Alumni (PJIMA), UiTM Perak Branch

Bauchemic (Malaysia) Sdn Bhd

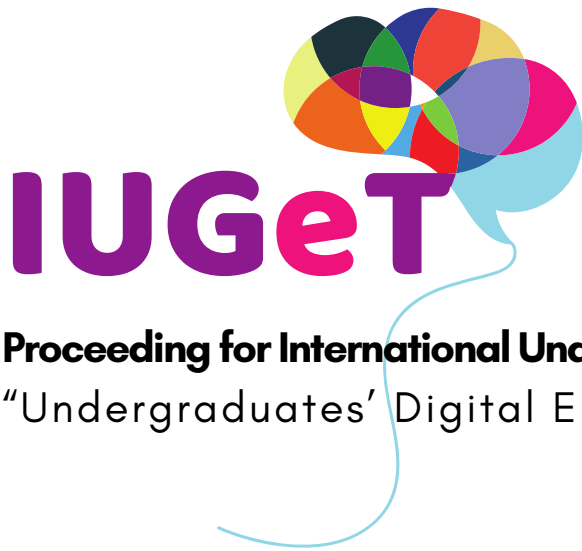
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SMART ROOM ENERGY TRACKER AUTOMATED ELECTRICAL USAGE CALCULATOR FOR INDIVIDUAL HOUSE

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Abstract

Manual tracking methods that are time-consuming and lack detailed insights often impede energy management in modern houses. The Smart Room Energy Tracker addresses these challenges by providing a comprehensive platform for analysing electrical consumption on a room-by-room basis using Excel. This innovation leverages existing energy formulas to offer detailed insights into energy usage patterns, which are essential for effective energy management. The methodology involves user data entry, automated calculations, and detailed analysis, including pie and bar charts, to visualise energy performance. Results show a significant improvement in energy management, with the system enabling precise identification of high-consumption areas and facilitating targeted energy-saving measures. The Smart Room Energy Tracker enhances energy efficiency, supports informed decision-making, and improves overall household comfort. The system's commercial potential lies in its ability to provide cost-saving benefits, promote sustainability, and optimise energy use through quick and clear analysis.

Keywords: *Energy Consumption, Energy Tracking, Energy Management, Automated Energy Calculator, Energy Performance*

1. INTRODUCTION

Manual tracking methods, which are time-consuming and error-prone, often hinder energy management in modern houses and lack detailed insights. Homeowners struggle to identify high-consumption appliances and rooms, leading to inefficient energy use and higher costs. In the scope of technology in green buildings, the Smart Room Energy Tracker is an innovative project aimed at providing detailed insights into the electrical consumption of individual rooms within a house. By implementing a comprehensive system of data collection and data analysis, this project seeks to help homeowners better understand and manage their energy usage, ultimately leading to increased energy efficiency and cost savings. The Smart Room Energy Tracker addresses these issues by leveraging existing energy formulas and creating a comprehensive platform using Excel to analyse energy consumption on a room-by-room basis. Energy consumption patterns also vary based on income, family size, and appliance stock (Sonawane & Gumaste, 2019).

Understanding these variations is crucial for developing effective energy management strategies and promoting renewable energy solutions (Yussouff et al., 2023). By utilising raw data on types of appliances, number of appliances, power (wattage), duration of usage by hour, and gross floor area, the Smart Room Energy Tracker provides detailed calculations and actionable insights. Preliminary results demonstrate significant improvements in energy management and cost savings, showcasing the platform's potential for broader adoption and sustainable energy use.

2. METHOD OF DATA PROCESSING

This flowchart represents the steps involved in using the Smart Room Energy Tracker, from starting the application to analyse energy performance and accessing additional information. The process is divided into three main sections: user data entry, automatic calculations, and the final analysis process.

Flow Of Smart Room Energy Tracker Automated Electrical Usage Calculator For Individual House;

A[Click Icon to Start] --> B[Insert Owner's Name and Home Address];
B --> C[Select a Room/Location from Drop-down List];
C --> D[List Appliances from Drop-down List];
D --> E[Insert Unit (no.) and Power (W)];
E --> F[Calculate Total Power (Automatically)];
F --> G[Tick Usage Hours];
G --> H[Calculate Total Hours (Automatically)];
H --> I[Calculate Total Electricity Used (Automatically)];
I --> J[Insert Gross Floor Area];
J --> K[Calculate Energy Performance (Automatically)];
K --> L[Generate Analysis (Pie Chart and Bar Chart Automatically)];
L --> M[Information Icon (Click for Explanation)];
M --> N[Direct Link to Explanation (Click on Items)];
N --> O[End];

Figure 1. Smart Room Energy Tracker Data Processing Method

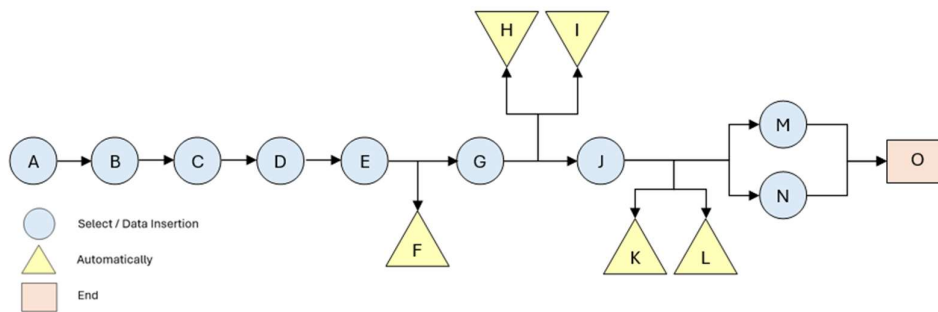


Figure 2. Smart Room Energy Tracker Data Processing Flow

In the user data entry section, the process begins with the user clicking an icon to start. Then, the system prompts the user to insert the owner's name and home address. Next, the user selects a room or location from a drop-down list and lists the appliances present in that room from another drop-down list. Next, the user provides the number of units and the power rating (in watts) for each appliance and selects the typical hours of usage for each appliance. In the automatic calculations section, the system calculates the total power consumption based on the units and power ratings entered. Based on the selected usage hours, the system automatically calculates the total duration of usage. The system calculates the total electricity used by multiplying the total power consumption by the total usage hours and converting it into kWh. Additionally, the system prompts the user to input the gross floor area of the room and calculates the energy performance for the room by utilising the total electricity used and the gross floor area.

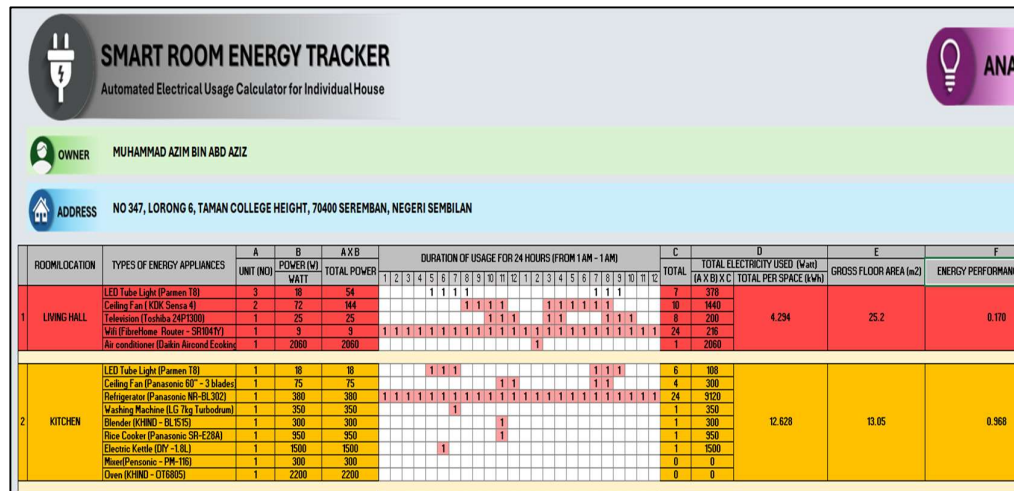


Figure 3. Main Page (Energy Tracker)

Finally, the system generates a pie chart and a bar chart in the analysis and end process section to visually represent the energy performance of each space. Users can click an information icon for detailed explanations and better understanding. Additionally, users can click on items within the energy tracker page for direct links to specific explanations. The detailed reading and analysis of data provides a clear representation of energy performance for each room, enabling users to easily detect the room with the highest energy consumption and take appropriate measures to optimise energy usage. The process is designed to be user-friendly, with automated calculations and visual aids to simplify energy management.

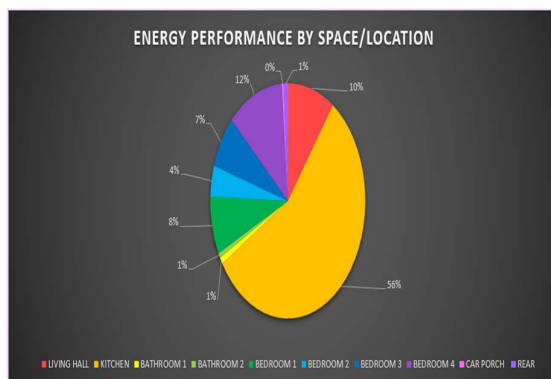


Figure 4. Auto Generated Pie Chart of Energy Performance By Space/Location (%)

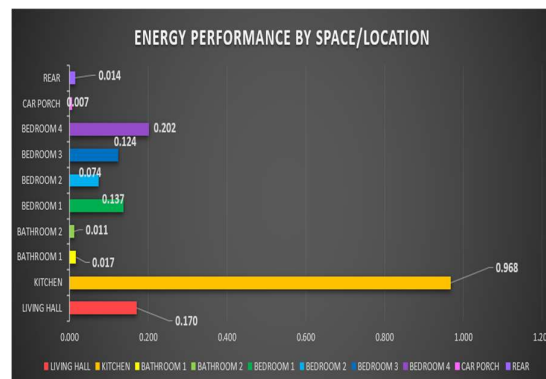


Figure 5. Auto Generated Bar Chart of Energy Performance By Space/Location (kWh/m²)

For calculation formatting, a variety of formulas are employed to accurately derive specific readings for energy consumption data collection. These formulas are used to ensure precise measurement and detailed analysis, providing a comprehensive understanding of energy usage patterns.

$$\text{Total Power (Watt)} = \text{Unit (No)} \times \text{Power Rating (Watt)}$$

where,

$$\text{Total Electricity Used (kWh)} = \frac{\text{Unit (No)} \times \text{Power Rating (Watt)} \times \text{Total Duration (Hours)}}{1000}$$

where,

$$\text{Energy Performance (kWh/m}^2\text{)} = \frac{\text{Total Electricity Used (kWh)}}{\text{Gross Floor Area (m}^2\text{)}}$$

3. RESULTS AND DISCUSSION

Before implementing the Smart Room Energy Tracker, homeowners relied on manual tracking methods, using individual appliance usage notes and utility bills. This approach offered limited insights, as energy bills only provided overall consumption without breaking down usage by specific rooms or appliances. Consequently, efforts to improve energy efficiency were based on broad, general advice rather than targeted, data-driven strategies. After implementing the Smart Room Energy Tracker, automated tracking and detailed analysis transformed the process. The system now provides a comprehensive overview of energy consumption for each room and appliance, offering precise, room-specific data that was previously unavailable. This detailed breakdown allows homeowners to identify and address specific areas of high energy use, facilitating targeted and effective energy-saving measures. As a result, the Smart Room Energy Tracker significantly enhances energy efficiency by enabling more informed and strategic decisions.

4. CONCLUSION

In conclusion, the Smart Room Energy Tracker demonstrates several key principles and generalisations derived from the results, notably enhancing energy management through automated tracking and detailed analysis. The system allows homeowners to precisely identify which rooms and appliances are consuming the most electricity, leading to targeted cost-saving measures. While the system generally supports improved energy efficiency and decision-making, it is important to address potential issues, such as data accuracy and user engagement. The theoretical implications suggest a shift towards more data-driven approaches in home energy management, while practical implications include enhanced comfort and convenience by enabling real-time adjustments to energy usage. The system empowers homeowners to make informed decisions about energy investments and practices, promoting a more sustainable and environmentally friendly household. Recommendations include leveraging the system for fast, clear analysis to optimise energy usage and reduce costs effectively.

5. ACKNOWLEDGMENT

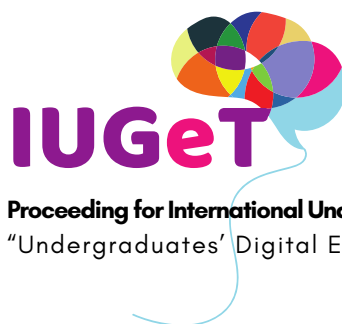
The authors extend their deepest gratitude to the homeowner for allowing their residence to be used as a case study for evaluating the workability and monitoring the outcomes of this innovation project.

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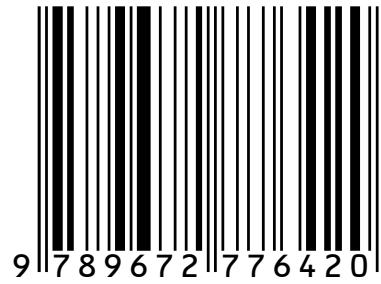
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