



E-ISSN:
2721-13988

PROCEEDINGS OF THE INTERNATIONAL CONFERENCE OF GRADUATE
SCHOOL ON SUSTAINABILITY (ICGSS)

9th International Conference on Sustainability (ICoS9)
University of Merdeka Malang, November 9th, 2024
<https://jurnal.unmer.ac.id/index.php/icgss>

MECHANICAL APPROACH TO ANALYZING THERMAL COMFORT IN SHOPPING MALL BUILDINGS

Kuscahyono¹, Hery Budiyanto¹, Imam Santoso.¹

¹ Magister Arsitektur, Universitas Merdeka Malang, Jl. Terusan Raya Dieng No.59 Malang

*Corresponding Author: kschyno2012@gmail.

Abstract

The gap in this research encourages researchers to conduct a more in-depth analysis of the factors affecting thermal comfort in shopping mall buildings. By employing a mechanical approach, researchers can identify potential improvements that enhance the thermal comfort of building visitors and occupants. The primary objective of this research is to enhance the environmental quality within shopping mall buildings and provide a more enjoyable experience for their users. Additionally, this research is expected to contribute to the development of environmentally friendly and sustainable building designs. Thus, the results of this research are expected to serve as a reference for developers and architects in designing better shopping center buildings in the future. Additionally, this research will also assess the use of environmentally friendly materials and renewable energy technologies that can help mitigate the environmental impact of the building. Thus, it is expected that the shopping center building resulting from this research will not only provide comfort to its users but also enhance their overall experience. Adopting energy-efficient lighting technology by transitioning from traditional neon lights to LED lighting. This study demonstrates that enhanced lighting scenarios can reduce lighting consumption levels by 51.7%, thereby contributing to a lower thermal load on the HVAC system. Research on building thermal comfort based on energy-saving concepts highlights several areas where further investigation is needed. Areas that require further research include the use of environmentally friendly materials for thermal insulation, the development of more efficient cooling and heating technologies, and architectural design strategies that maximize natural air circulation.

Keywords: Energy savings, Thermal comfort, Mall

1. Introduction

Indonesia is a country with diverse climates, one of which is the tropical climate. The tropical climate is generally located within the range of 0 ° to 23.5 °. This climate is characterized by hot weather and has only two seasons: the rainy season and the dry season. The dry season typically occurs from March to August, while the rainy season generally takes place from September to February. Therefore, the tropical climate in Indonesia can impact a person's comfort both indoors and outdoors (Cetta et al., 2023). The impact of the tropical climate on building users includes uncomfortable air circulation conditions (too cold or too hot), which tend to decrease productivity. The majority of Indonesian society in the modern era are users of buildings, whether in terms of commercial buildings, retail, shopping centers, or shophouses (Farisi & Satwikasari, n.d.).

Based on previous research, it is evident that the mechanical approach to analyzing the thermal comfort of shopping mall buildings has several interrelated aspects. Among these, many shopping malls experience air temperatures exceeding comfort limits, with average



E-ISSN:
2721-13988

PROCEEDINGS OF THE INTERNATIONAL CONFERENCE OF GRADUATE SCHOOL ON SUSTAINABILITY (ICGSS)

9th International Conference on Sustainability (ICoS9)
University of Merdeka Malang, November 9th, 2024
<https://jurnal.unmer.ac.id/index.php/icgss>

temperatures above 27.2 °C and high humidity, which can cause discomfort for visitors and employees (Latifah et al., 2013). The low wind speed inside the building also contributes to this condition, so the airflow is not sufficient to create thermal comfort (Farisi & Satwikasari, n.d.). The architectural design and configuration of air openings often do not support optimal airflow. For example, the type of opening used is not capable of facilitating effective cross ventilation, resulting in heat accumulation inside the room (Pandu K. Utomo et al., 2023). This indicates the need for evaluation and improvement in the opening design to enhance air circulation. Shopping centers located in urban areas are often affected by the Urban Heat Island phenomenon, where the surrounding temperature is higher compared to rural areas. This can worsen the thermal comfort conditions inside the building (Dermentzis, 2018). Although physical data indicate certain conditions, users' subjective perception of thermal comfort often differs. Research shows that although temperature and humidity are at certain levels, many users feel uncomfortable, indicating a need to consider psychological factors in building design (Pandu K. Utomo et al., 2023). The existing HVAC system may not be functioning optimally to meet the thermal comfort needs of users. Previous research has shown that without adequate artificial ventilation, many areas in shopping centers cannot achieve the expected level of thermal comfort (Dermentzis, 2018).

By understanding these issues, the research aims to provide more effective design recommendations and management strategies to enhance thermal comfort in shopping centers, thereby creating a more comfortable environment for all users.

A review of previous studies shows that a mechanical approach to analyzing thermal comfort in shopping mall buildings must consider various factors, including architectural design, ventilation systems, and user perception. These studies offer valuable insights into how these elements interact to create a comfortable environment for both visitors and employees. The recommendations from these studies can be used as a basis for further research in designing shopping centers that are more thermally efficient and comfortable.

Previous studies on the mechanical approach in analyzing the thermal comfort of shopping mall buildings have several main objectives: to evaluate the level of thermal comfort inside the shopping mall by measuring physical parameters such as air temperature, humidity, and wind speed (Adhyasa, 2020). Understanding how architectural design, including openings and natural ventilation, affects thermal comfort, (Pandu K. Utomo et al., 2023) providing design recommendations that can enhance thermal comfort in shopping centers. This recommendation includes suggestions on the use of suitable materials and the implementation of a more effective ventilation system. (Pandu K. Utomo et al., 2023) . to analyze and evaluate thermal comfort conditions in office spaces, especially comparing environments with and without air conditioning (AC) to determine which conditions provide optimal comfort for users (Kamaruddin, 2023).

Some assumptions underlying previous studies include that external environmental conditions during measurements remain stable, so that the measurement results inside the building can be considered representative, the existing HVAC system functions well, capable of regulating temperature and humidity according to user needs, and thermal comfort perception can vary between individuals based on factors such as physical activity, personal preferences, and conditions. Health and historical data regarding temperature and humidity at the research location are considered relevant to provide context for the measurement results. at the moment.



E-ISSN:
2721-13988

With those goals and assumptions, previous studies have made significant contributions to understanding thermal comfort in shopping mall buildings and have offered practical solutions to enhance the user experience.

2. Method

The methodology employed by Grassi et al. involves a systematic approach to selecting and analyzing literature related to thermal comfort control in buildings. Here are the key steps outlined in this research (Dermentzis, 2018):

- **Literature Search:** The author conducted a comprehensive search for relevant papers published between 2017 and 2021. They aim to identify studies that present solutions for controlling indoor environments to enhance or maintain thermal comfort. The search was conducted using scientific databases, resulting in an initial set of several articles.
- **Selection Criteria:** To refine the selection, the author has established specific criteria. They focus on papers that simultaneously present thermal comfort models and control systems. These dual requirements ensure that the selected studies are relevant to the research objectives of understanding and enhancing thermal comfort through effective control strategies.
- **Screening Process:** The initial screening involves a quick read of the abstract to exclude papers that do not meet the criteria. This process narrows down the selection to a few papers, which are then exported for further analysis. In the end, the discussion is detailed in the paper.
- **Data Extraction and Analysis:** The author created an additional spreadsheet to record and analyze the selected studies. This database encompasses various fields, including thermal comfort models, control strategies, and practical considerations. The spreadsheet serves as a valuable resource for readers to filter and select studies based on specific interests, such as types of interventions or comfort models.
- **Keyword Analysis:** The author also conducts keyword analysis to identify the relationships between different concepts in the literature. This analysis helps visualize the relationship between thermal comfort, control methods, and energy efficiency, providing insights into the broader research (Pandu K. Utomo et al., 2023).
- **Field measurements in four shopping centers.** - Experimental evaluation (Xue & Zhao, 2021).

3. Results and Discussion

The research results indicate that building design, ventilation systems, and the interaction between physical factors and user perceptions all significantly affect thermal comfort in business areas. The findings from these studies offer valuable insights into the challenges of creating a safe environment and provide practical solutions to enhance user satisfaction in various types of commercial buildings. Furthermore, studies show that thermal comfort in business environments can be directly correlated with the threshold of visits and sales in stores. Because of this, it is important for business owners and managers to consider



E-ISSN:
2721-13988

the factors that affect thermal comfort in order to create a user-friendly environment. The results of this research provide valuable insights into improving thermal comfort control in commercial buildings, ultimately offering a more engaging experience for users. Implement an automatic control system for air conditioning that can adjust the temperature according to the number of people in the room (A et al., 2024). Analyze the thermal comfort provided by various materials used in building envelopes. This involves measuring temperature and humidity levels to determine how well a building maintains a comfortable environment for its occupants (Prakoso et al., 2014). The use of advanced technology in lighting control systems has dual benefits: direct savings due to better performance of lighting fixtures, and indirect savings through reduced thermal loads, resulting in reduced air conditioning consumption levels (Pompei et al., 2023).

4. Conclusion

The results of previous studies' discussions indicate that thermal comfort in shopping centers is significantly influenced by architectural design, ventilation systems, and the interaction between physical factors and user perception. These studies offer valuable insights into the challenges of creating a comfortable environment and provide practical solutions to enhance the user experience in various types of commercial buildings. Some practical solutions that can be implemented to enhance user experience in various types of commercial buildings include improving the quality of ventilation systems, paying attention to architectural designs that consider thermal comfort, and strengthening the interaction between physical factors and user perception. By considering the findings from previous studies, architects and building designers can create more comfortable environments and improve user experiences in shopping centers and other commercial buildings. Thus, it can be expected that user comfort will increase, creating a more pleasant atmosphere for visitors.

Referensi

- A, Y. P. E., Pido, R., & Boli, R. H. (2024). *Analisis Kenyamanan Termal Pada Gedung BPJS Kesehatan Cabang Gorontalo*. 3(2), 5–11.
- Adhyasa, R. (2020). *Kenyamanan Termal Pada Ruang Luar Mall The Breeze Di Tangerang*. 2.
- Cetta, E. M., Surjanto, A., & Arman, M. (2023). *Analisis Kenyamanan Berbasis Termal Pada Ruang Baca Perpustakaan*. 164–168.
- Dermentzis, F. O. (2018). Healthy , Intelligent and Resilient Buildings and Urban Environments. *7th International Buildings Physics Conference, IBPC2018, September 2018*, 6.
- Farisi, F. Al, & Satwikasari, A. F. (n.d.). *PERBELANJAAN MODERN TRANSMART CIBUBUR*.



E-ISSN:
2721-13988

PROCEEDINGS OF THE INTERNATIONAL CONFERENCE OF GRADUATE
SCHOOL ON SUSTAINABILITY (ICGSS)

9th International Conference on Sustainability (ICoS9)

University of Merdeka Malang, November 9th, 2024

<https://jurnal.unmer.ac.id/index.php/icgss>

-
- Kamaruddin, N. (2023). Kajian Kenyamanan Termal Ruang Perkantoran. *Jurnal Ruang*, 17(1), 54–59.
- Latifah, N. L., Perdana, H., Prasetya, A., & Siahaan, O. P. M. (2013). Kajian Kenyamanan Termal pada Bangunan Student Center ITENAS Bandung (Study of Thermal Comfort in Student Center Buildings Itenas Bandung). *Reka Karsa: Jurnal Arsitektur (Reka Karsa: Architectural Journal)*, 1(1), 1–12.
- Pandu K. Utomo, Dharwati P. Sari, Harta D. Nanda, & Cindy U. Nurjannah. (2023). Pengaruh Konfigurasi Ruang Terhadap Kenyamanan Termal Pengguna Gedung di Daerah Beriklim Tropis Lembap. *Jurnal Arsitektur Zonasi*, 6(1), 185–196.
- Pompei, L., Nardecchia, F., Viglianese, G., & Rosa, F. (2023). *Towards the Renovation of Energy-Intensive Building : The Impact of Lighting and Free-Cooling Retrofitting Strategies in a Shopping Mall*.
- Prakoso, N. A., Lamahala, A. K., & Sentanu, G. (2014). *Kajian Penerapan Material pada Selubung Bangunan yang Mempengaruhi Kenyamanan Termal dan Visual*. 2(2), 1–12.
- Xue, F., & Zhao, J. (2021). *Building Thermal Comfort Research Based on Energy-Saving Concept*. 2021.