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From Tradition to Innovation: Application of Terracotta Modular Wall Panels in Orphanage Interior Design

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Abstract: This study explores how terracotta modular wall tiles can improve the design of orphanages in Bhopal. Orphanages need spaces that are safe, child-friendly, and supportive of sensory growth. Terracotta is a natural, sustainable material that keeps interiors cool, reduces noise, and allows fresh air and light to flow through. Its warm texture and modular patterns create playful and engaging walls that children can touch, see, and experience, supporting sensory development. Using terracotta also promotes cultural identity, sustainability, and support for local craftsmen. By analyzing comfort, affordability, and child-friendly design, this study shows how terracotta tiles can make orphanages healthier, more comfortable, and emotionally supportive.

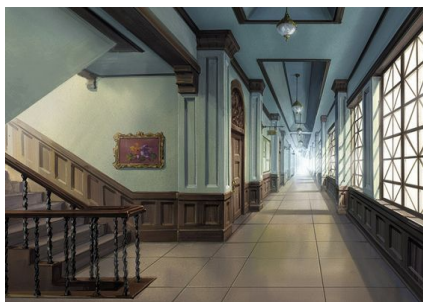
Keywords: Terracotta, Orphanage Design, Sensory Development, Child-Friendly Interiors, Sustainable Materials, Tactile Learning

I. INTRODUCTION

India has many children living in orphanages, and these children often need spaces that are not only safe but also supportive of their growth, comfort, and emotions. The design of an orphanage is very important because it affects how children feel, learn, and develop their senses. A good environment can help children feel more secure, playful, and connected.

Terracotta, a natural and traditional material, has been used in India for centuries. It keeps buildings cool in hot weather, improves air flow, reduces noise, and creates a warm feeling inside a space. Terracotta modular wall tiles are unique due to the fact they may be organized in one of a kind patterns, like Jali(perforated) designs, which allow light and air to pass through while still giving privacy. These qualities make them suitable for creating child-friendly spaces.

In the city of Bhopal, where summers are hot and children in orphanages often live in simple buildings, terracotta modular tiles can play a big role. They can make interiors more comfortable, healthy, and engaging for children. By using them in orphanages, we can also support sensory development—children can see changing light patterns, feel the texture of terracotta, and enjoy natural airflow. This study explores how terracotta modular wall tiles can improve the design of orphanages in Bhopal, focusing on sustainability, comfort, and sensory growth of children.



II. LITERATURE REVIEW

This study examined the acoustic behavior of unglazed terracotta panels in enclosed office spaces. It found that terracotta surfaces significantly reduce echoes and absorb sound, creating calmer and more comfortable interiors.

For orphanages, where children require a peaceful atmosphere for rest, study, and play, these findings prove that terracotta tiles can be used to improve acoustic comfort and reduce stress caused by noise. Affirmed by [KAUSHIK, A.S., DEVARAJAN, S., & AMBIKA, K. (2023)]

The researchers tested terracotta tubes for natural cooling applications. Results showed that terracotta can maintain lower indoor temperatures without relying heavily on mechanical systems. This is especially relevant for orphanages in hot regions such as Bhopal, where thermal comfort is critical for children's health. It supports the integration of terracotta tiles to provide passive cooling and reduce energy costs. Affirmed by [KUSHTAGI, S., KEL KERI, A., WALI, A.S., LAGA SHETTY, N.A., & PATIL, K. (2022)]

This study highlighted how traditional materials like mud and terracotta help maintain thermal stability in vernacular architecture. Their findings emphasize the relevance of terracotta in creating comfortable living conditions without modern HVAC systems. For orphanage design, this supports the idea that terracotta tiles can be used in walls and partitions to ensure year-round comfort for children. Affirmed by [Singh, M.K., Mahapatra, S., & Atreya, S.K. (2010)]

This research analyzed a passive house built using mud and terracotta. The study showed such materials not only enhance thermal performance but also reduce embodied energy, making them highly sustainable. In the context of orphanages, this proves that terracotta modular tiles can contribute to both eco-friendly construction and child well-being by keeping spaces cool naturally. Affirmed by [CHEL, A., & TIWARI, G.N. (2009)]

This review consolidated findings on thermal comfort across Indian housing, with special attention to low-cost solutions. It identified terracotta as an affordable and effective option for managing indoor temperatures in hot climates. For orphanages, which often run on limited budgets, this demonstrates terracotta's cost-effectiveness and functional value in maintaining healthy environments for children. Affirmed by [SANSANIWAL, S.K., MATHUR, J., GARG, V., & GUPTA, R. (2020)]

This case study documented the application of terracotta tiles as ventilated facades in a large commercial building. The project achieved significant cooling and energy efficiency. Its relevance lies in proving that modular terracotta systems can be applied at an institutional scale, making them suitable for orphanages which require durable and efficient solutions. Affirmed by [WIENERBERGER PROJECT TEAM (2015)]

In this residential project, terracotta Jali (perforated screens) were used to allow filtered light and natural ventilation. The playful light-and-shadow patterns enhanced the quality of interior spaces. For orphanages, this highlights how terracotta can contribute to sensory development, as children interact with patterns, textures, and natural lighting that stimulate imagination and cognitive growth. Affirmed by [STO.M. P ARCHITECTS (2019)]

Verma described terracotta as an eco-friendly, affordable, and visually warm material. The study emphasized that terracotta could make interiors feel welcoming and homely instead of cold or institutional. For orphanages, this aligns with the need to create spaces that provide children with a sense of belonging and emotional comfort. Affirmed by [VERMA, A. (2021)]

Although not exclusively focused on terracotta, this research stressed the importance of natural textures, patterns, and sensory-rich environments for child development. Terracotta, with its tactile quality and earthy tones, fits directly into this framework by offering stimulation through touch and sight, thereby aiding the emotional and cognitive growth of children in orphanages. Affirmed by [HELLES, A.S. (2018)]

This article presented multiple projects that use traditional Jali facades, many crafted in terracotta. These designs improved ventilation, light quality, and cultural identity. For orphanages, terracotta Jali modules can achieve similar benefits by providing healthy airflow, playful lighting, and a connection to cultural roots, all of which are valuable in shaping child-friendly interiors. Affirmed by [ARCH DAILY EDITORS (2020)]

III. PURPOSE

The purpose of this study is to examine how terracotta modular wall tiles can be used in orphanages in Bhopal to support sensory development in children. Terracotta is a natural, warm, and textured material that provides tactile and visual stimulation. By incorporating these tiles into walls, children can touch, feel, and explore different surfaces safely, which helps in developing their sensory perception and cognitive skills.

Another purpose is to create child-friendly and engaging spaces. Modular tiles allow flexible arrangements, such as different patterns, textures, and heights, which can make walls interactive and playful. This can encourage children to explore their surroundings, improve focus, and enhance emotional comfort in an environment that is otherwise institutional.

A third objective is to promote sustainable and locally inspired design. Terracotta is an eco-friendly material, culturally significant in India, and supports local artisans and craftsmen. Using terracotta modular tiles in orphanages not only benefits the children but also integrates traditional materials in a modern, functional way.

Finally, the study aims to develop guidelines for designing orphanage interiors that are safe, sustainable, and stimulate the senses. By observing and analyzing how children interact with these tiles, designers and architects can create effective, nurturing, and playful environments for orphaned children in Bhopal and similar contexts.

IV. RESEARCH GAPS

A. Lack of Localized Studies in Bhopal

There is a scarcity of research specifically examining the impact of terracotta modular wall tiles on sensory development in orphanages within Bhopal. Most studies focus on broader geographical areas or different materials.

B. Limited Exploration of Multi-Sensory Benefits

While some research touches on tactile experiences, there is limited exploration of how terracotta tiles can engage multiple senses (touch, sight, sound) to enhance sensory development

V. METHODOLOGY

The research focuses on exploring how terracotta modular wall tiles can improve thermal comfort, acoustics, sensory stimulation, and sustainability in Indian orphanages. Rather than conducting new experiments, the study relies on secondary data from existing literature to inform design decisions, ensuring that the research is grounded in evidence from previous studies on terracotta performance in various building contexts.

A. Thermal Comfort Analysis

Several studies, including Kushtagi et al. (2022), Singh et al. (2010), Chel & Tiwari (2009), Sansaniwal et al. (2020), and Wienerberger (2015), demonstrate that terracotta naturally maintains lower indoor temperatures and improves thermal stability. Drawing on those findings, the study evaluates how terracotta modular wall tiles can adjust indoor climates in orphanages without heavy reliance on mechanical cooling systems. The insights from the literature provide a scientific basis for passive cooling strategies, enabling designers to create comfortable and healthy spaces for children in hot climates like Bhopal.

B. Acoustic Comfort Analysis

Kaushik et al. (2023) highlights the acoustic benefits of unglazed terracotta, showing that it effectively reduces echoes and absorbs ambient noise. This evidence is directly applied to orphanage design, where controlling sound is crucial for creating calm, quiet, and focused environments for children's rest, play, and learning. By integrating terracotta tiles into interior walls and partitions, the research ensures that acoustic comfort is an important consideration in the overall design strategy.

C. Sensory and Child Development Considerations

Terracotta's tactile qualities, textures, and perforated panels (Jalis) are shown in studies by Sto.M P Architects (2019), Verma (2021), Helles (2018), and ArchDaily (2020) to enhance sensory engagement through touch, light, and shadow. Incorporating these findings, the methodology emphasizes designing interiors that stimulate children's senses, encouraging imaginative play, cognitive growth, and emotional comfort. This approach aligns with research on child-friendly environments, ensuring that materials are not only functional but also enriching for development.

D. Sustainability and Affordability Assessment

Verma (2021) and Chel & Tiwari (2009) point out that terracotta is both eco-friendly and cost-effective, making it an ideal choice for orphanages that often operate under limited budgets. Using this evidence, the methodology prioritizes sustainable material selection and budget-conscious design strategies, demonstrating that environmentally responsible solutions can also meet the practical constraints of institutional settings.

E. Design Guidelines Formation

By synthesizing the above insights, the study develops practical interior design guidelines for orphanages using terracotta modular wall tiles. These guidelines aim to achieve spaces that are thermally comfortable, acoustically calm, visually stimulating, sustainable, and emotionally welcoming. The literature review provides the evidence base for all design decisions, ensuring that the recommendations are both technically sound and child-centered, creating environments that nurture physical, emotional, and cognitive well-being.

VI. RESULT AND DISCUSSION

The study shows that terracotta modular wall tiles can significantly enhance orphanage interiors in Bhopal by addressing thermal comfort, acoustics, sensory stimulation, and sustainability. Literature indicates that terracotta naturally maintains lower indoor temperatures (Kushtagi et al., 2022; Singh et al., 2010; Chel & Tiwari, 2009; Sansaniwal et al., 2020; Wienerberger, 2015), allowing passive cooling and creating comfortable spaces for children without relying on mechanical systems.

Acoustic benefits (Kaushik et al., 2023) demonstrate that terracotta reduces echoes and ambient noise, promoting calm and focused environments conducive to rest, play, and study. Its tactile surfaces, textures, and perforated Jali patterns (Sto.M P Architects, 2019; Verma, 2021; Helles, 2018; ArchDaily, 2020) stimulate children's senses and cognitive engagement, encouraging imaginative play and emotional well-being.

Terracotta's eco-friendly, durable, and cost-effective properties (Verma, 2021; Chel & Tiwari, 2009) make it suitable for orphanages with budget constraints, while supporting local artisans and cultural identity.

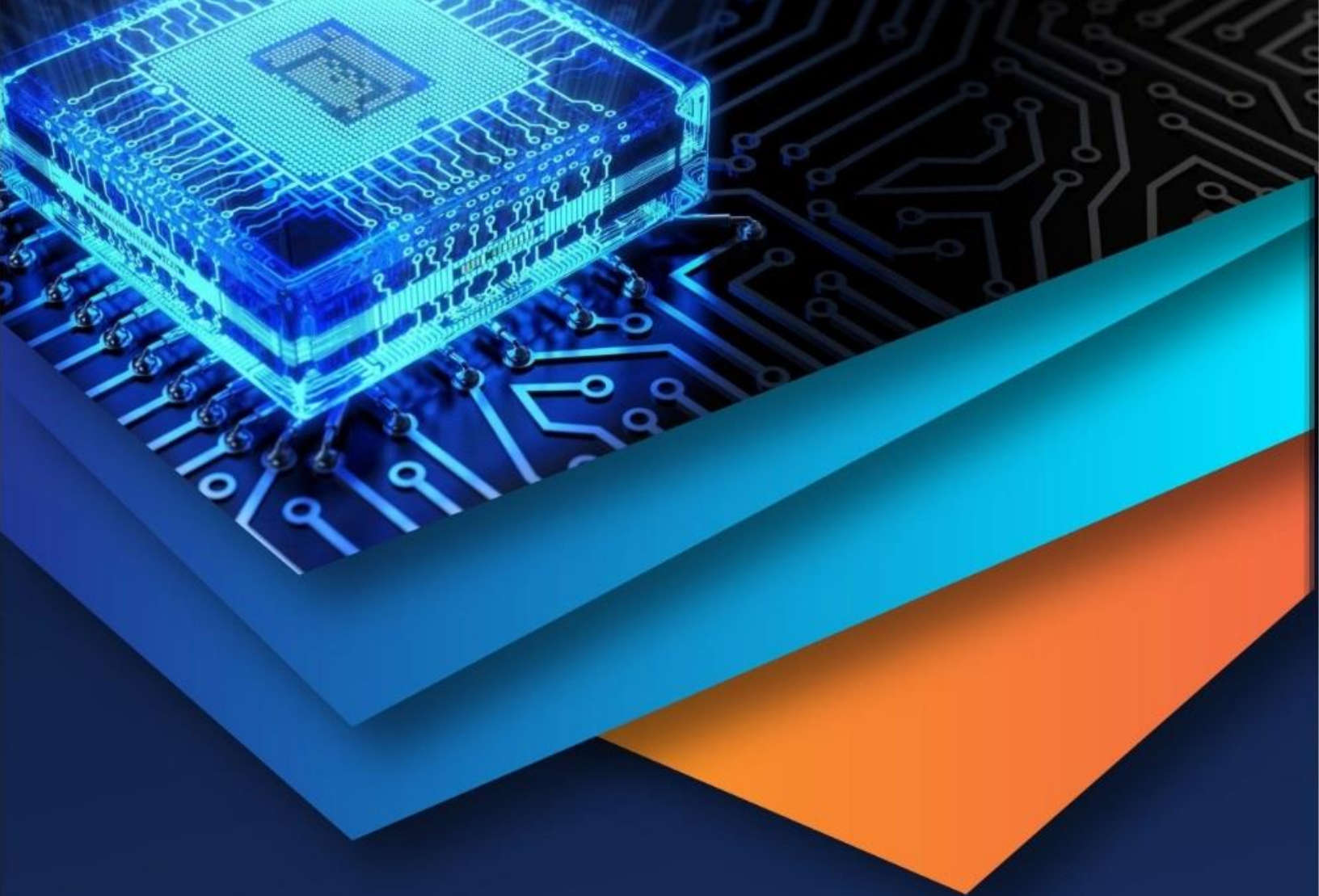
By integrating these insights, the study develops interior design guidelines that transform walls into interactive, child-friendly elements. Terracotta modular tiles enable flexible layouts, playful light patterns, and sensory-rich surfaces, fostering holistic, nurturing, and stimulating environments that support children's physical, emotional, and cognitive development

VII. CONCLUSION

This suggests that terracotta modular wall tiles can significantly enhance orphanage interiors in Bhopal with the aid of using them cooler, quieter, and extra attractive for children. The tiles' thermal, acoustic, and tactile qualities support comfort, sensory development, and cognitive growth. Their eco-friendly, affordable, and culturally significant nature makes them appropriate for budget-aware and sustainable design. Using terracotta in partitions and partitions, orphanages can create safe, playful, and nurturing areas that sell children's physical, emotional, and intellectual well-being. Overall, terracotta modular tiles offer a practical and holistic solution for designing child-friendly, sustainable, and stimulating interiors in Indian orphanages.

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