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Optimizing design thinking process for group housing through interaction design methods

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Abstract

This research paper investigates the optimization of the Design Thinking (DT) process for group housing projects by using Interaction Design (IxD) methods. Group housing design is increasingly complicated as it attempts to balance individual requirements, community behavior, and sustainability. Through the integration of Design Thinking principles—empathy, ideation, prototyping, and iteration. This article proposes a hybrid approach that combines Interaction Design (IxD) methods, including empathy mapping, interactive prototyping, and real-time feedback systems, to optimize DT's phases (empathize, ideate, prototype, test) in group housing. Through a series of case studies, the research shows how IxD's focus on dynamic user interactions and iterative co-design increases participatory outcomes. Key outcomes are a 30% increase in resident satisfaction with communal spaces, a 25% decrease in design iteration cycles, and enhanced conflict resolution in shared spaces through means such as behavioral analytics and VR-based spatial simulations. The framework not only closes gaps in DT's usage but also encourages interdisciplinary collaboration, allowing architects and interaction designers to co-create flexible, user-oriented living spaces. Practical considerations for large-scale housing solutions are debated, including limitations to cultural responsiveness and resources needed. Recommendations are provided to bring digital-physical feedback tools into policy and practice at the end of the study, which is a path for future work across different socio-spatial environments.

Keywords: interaction design, design thinking, group housing, user-centered design, spatial innovation

1. Introduction

1.1. Context

Growing demand for user-focused and sustainable group housing has led to a transition away from conventional housing structures towards more collaborative living situations (UN-Habitat, 2022). Group housing, such as co-housing, cooperative housing, and shared residences, seeks to reconcile personal autonomy with the good of the group through social engagement, sharing, and environmentally conscious living habits (Akinsulire et al., 2024).

Nevertheless, conventional housing design procedures tend to be inadequate in dealing with the intricate social and spatial relations involved in collective living. Static planning is favored by conventional architectural procedures, making spaces less responsive to changing residents' needs (Eizenberg & Jabareen, 2017). Additionally, the lack of iterative, user-led feedback processes results in design imbalances, eventually influencing resident satisfaction and social cohesion (Díaz & Aedo, 2020).

To transcend these constraints, human-centered design approaches like Design Thinking (DT) and Interaction Design (IxD) are gaining popularity. DT focuses on empathy, ideation, prototyping, and iterative testing, enabling more flexible and inclusive housing solutions (Brown & Wyatt, 2010). In contrast, IxD, originally related to human-computer interaction, applies its principles of

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interactivity, feedback loops, and user experience mapping to designing physical environments (Srisombut et al., 2021). By combining these two fields, architects and urban planners can develop dynamically responsive housing systems that accommodate varied resident requirements while improving social integration and sustainability.

1.2. Problem Statement

Even with the potential of group housing as a sustainable and socially enhancing model, its success hinges on the efficiency of the design process. Conventional architectural practices are frequently lacking in Understand resident needs: Accurately capture the diverse needs, preferences, and lifestyles of prospective residents. Promote collaboration: Facilitate meaningful participation and co-creation among residents in the design process. Optimize shared spaces: Design shared spaces that encourage interaction, foster a sense of community, and accommodate a variety of activities. Balance individual and collective needs: Strike a balance between individual privacy and autonomy and the collective needs of the community. Address potential conflicts: Anticipate and mitigate potential conflicts arising from shared living arrangements. (Wiles et al., 2011).

Additionally, current Design Thinking methods in architecture are more concerned with aesthetics and spatial optimization than user interaction and adaptive co-design. This leads to inflexible housing models that fail to adapt to community needs. Thus, this study aims to redefine the Design Thinking process by incorporating Interaction Design methods, allowing for a more responsive, participatory, and resident-centered housing model.

1.3. Research Objectives

This study seeks to maximize the Design Thinking process for group housing through the incorporation of Interaction Design practices. The particular goals are:

1.3.1. Identify Key Challenges

Determine major challenges in using Design Thinking for group housing through a review of current case studies and literature.

1.3.2. Evaluate Existing Methods

Assess the efficacy of Interaction Design methods (e.g., empathy mapping, interactive prototyping, real-time feedback systems) in improving participatory housing design.

1.3.3. Develop a Refined Framework

Create an evolved framework that incorporates Interaction Design principles into the Design Thinking stages (Empathize, Ideate, Prototype, Test).

1.4. Significance of the Study

This research is a contribution to the innovation in housing design through proposing an holistic framework for improving resident involvement, spatial flexibility, and participatory self-governance. The outcomes are especially applicable to:

1.4.1. Architects & Designers

Delivering a systematic method for developing user-oriented and socially interactive housing typologies.

1.4.2. Urban Planners & Developers

Offering insights into scalable, cost-efficient, and flexible forms of housing.

1.4.3. Residents & Co-Housing Communities

Enabling people to engage actively in the co-creation of their living places.

1.4.4. Policy Makers & Housing Authorities

Guiding policy reforms that promote resident-led housing models and integrating digital feedback.

By bridging the gap between Interaction Design and Design Thinking, this research opens up possibilities for interdisciplinary collaboration, enabling architects, urban planners, and interaction designers to collaborate on designing adaptable, user-oriented, and socially sustainable collective housing solutions.

2. Literature Review

2.1. Design Thinking

Design thinking is an iterative human-centered problem-solving process focusing on understanding the needs of users, creating innovative solutions, and developing them through testing (Lka, 2020). The process is normally divided into five major stages: empathize, define, ideate, prototype, and test (Haryuda et al., 2021). The empathize stage entails intense immersion with users using observation, interviewing, and being in the environment to understand users' needs, behaviors, and motivations (Hou et al., 2019). Empathize phase ensures that real problems are noted by designers as opposed to cosmetic issues (Darmawan et al., 2022). The define phase integrates research insights to create an unambiguous, human-focused problem statement (Tu et al., 2018). An accurate problem gives the next step of the design process direction so that solutions can align with the user's needs (Elsbach & Stigliani, 2018). The ideate stage promotes the examination of several potential solutions through brainstorming, drawing, and other creative methods (Nasution & Nusa, 2021). The ideate stage prioritizes quality over quantity but encourages innovation by focusing on as many ideas as possible (Sari et al., 2020). The prototype stage focuses on creating tangible representations of the solution, from low-fidelity paper prototypes to high-fidelity interactive systems (Johansson & Arvola, 2007). Prototyping facilitates the collection of user feedback prior to full-scale implementation (Häggman et al., 2013). The testing phase tests prototypes against users to establish areas for adjustment (Karnawan, 2021). Testing is done iteratively because learnings acquire result in modifications and iterations in prototyping (Micheli et al., 2018).

Design thinking is used extensively in architecture and urban planning to design spaces that are centered on user experience (Akinsulire et al., 2024). In residential projects, it allows architects to interact with the residents to know their spatial preferences and social behaviors, resulting in solutions that are both functional and aesthetic (Bilandzic et al., 2008). Urban planning is also enhanced by design thinking through the integration of community engagement into planning processes (Caramiaux et al., 2015). For instance, engaging citizens in co-creation workshops ensures that public areas are safe, accessible, and designed according to their requirements (Kappel et al., 2017). Further, sustainability issues, such as energy-efficient construction and green infrastructure, can be resolved through iterative prototyping and user testing (Oluwafeyikemi & Gwilliam, 2015). Through the incorporation of design thinking in housing and urban planning, solutions are more responsive to changing user requirements and urban situations, and hence it is a worthwhile method for modern housing problems.

2.2. Interaction Design

Interaction design (IxD) is centered around designing intuitive and compelling experiences by defining how users interact with products, services, and spaces (Jacko & Sears, 2013). Its main methods—user research, prototyping, usability testing, and scenario-based design—come together to shape refined design results. User research constitutes the process of observing the behaviors, preferences, and needs of users through methods like interviews, questionnaires, and ethnographic studies (Hou et al., 2019). These findings enable designers to design solutions that meet user expectations. Prototyping is an essential IxD tool that allows iterative improvement of design concepts (Johansson & Arvola, 2007). Low-fidelity paper concepts enable users to discover usability

problems early in the process (Häggman et al., 2013). Usability testing makes designed solutions accessible to users by obtaining feedback from actual users (Karnawan, 2021). It improves quality of functionality, accessibility, and overall satisfaction of the user.

Scenario-based design entails creating scenarios that illustrate how people engage with a system in varied contexts (De & Carrio, 2009). It is best suited for spatial design because it takes into account real-world interactions and changing environments. Interaction design not only addresses digital interfaces but also has implications on the ways humans engage with environments and societies (Broughton et al., 2009). IxD can add value to social interaction and user-friendliness within common living areas in group housing. As an example, structuring shared environments through interactive spaces—like smart living rooms or social media hubs for resident connection—fosters collaboration in balance with resident privacy (Caramiaux et al., 2015). Similarly, technology governing shared resource operation (i.e., LED bulbs, calendar books for use in shared public space) generates efficiency (Oluwafeyikemi & Gwilliam, 2015).

Interaction design also contributes to solving privacy issues by providing flexible environments in which residents are able to manage their exposure to shared space (Elsbach & Stigliani, 2018). Technologies for intelligent homes, for instance, enable the users to personalize lighting, access control, and sound insulation to strike a balance between community engagement and individual retreat (Broughton et al., 2009).

2.3. Group Housing

Group living is becoming a key solution to urban affordability, loneliness, and sustainability issues (Akinsulire et al., 2024). Co-living units, cooperative housing, and shared housing models are encouraged for their ability to ensure resource efficiency and social interaction at reduced individual costs. Yet the balance between privacy and community remains a problem. Successful design must create private refuge spaces while facilitating shared experience (Kappel et al., 2017). Furthermore, maintaining affordability in group housing models is essential since increasing urban housing prices tend to restrict inclusivity (Srisombut et al., 2021).

Group housing sustainability goes beyond energy efficiency to encompass behavioral and technological interventions promoting responsible consumption of resources (Oluwafeyikemi & Gwilliam, 2015). Smart systems to monitor energy consumption, automate lighting, and enable shared resource management can greatly enhance sustainability performance (Broughton et al., 2009). Through the incorporation of interaction design principles in group housing, digital and spatial interfaces can produce smooth experiences, strengthening social relationships while maintaining privacy and resource efficacy (Caramiaux et al., 2015).

2.4. Identified Gaps

One of the major research gaps is the disjointed application of design thinking and interaction design in housing development. While design thinking presents a comprehensive method to resolve issues, interaction design sharpens the micro-level aspects of the user experience (Micheli et al., 2018). Lack of an organized framework that combines the two approaches means missing chances for improving usability, community engagement, and sustainability. Modern home designs tend to overlook iterative testing available in interaction design methodologies, resulting in less-than-ideal community spaces and waste of resources (Jacko & Sears, 2013). Additionally, the absence of interdisciplinary collaboration among architects, urban designers, and interaction designers impedes comprehensive innovation in group housing.

A possible solution is to have a hybrid system in which design thinking informs the macro-housing strategy and interaction design reworks the micro-level user interface. Moreover, participatory design processes might bridge the gap by engaging residents in co-creating living environments (Caramiaux et al., 2015). By methodically embedding interaction design within the

design thinking process, group housing schemes can realize improved social connectivity, eco-friendly living, and responsive environments that accommodate shifting user requirements.

3. Methodology

The following section details the research methodologies used to examine the optimization of the Design Thinking process for group housing using interaction design approaches. The research applies a mixed-methods approach with a combination of case study analysis and participatory action research (PAR) to deliver an extensive overview of the design challenges and possibilities in group housing projects.

3.1. Research Approach

The study employs a mixed-methods research, which combines case study analysis with participatory action research (PAR). Mixed-methods research provides a richer understanding of complex phenomena by merging the strengths of both qualitative and quantitative methods (Sandelowski, 2013). This research approach deals with diversity and complexity, providing several views of the phenomena being studied (Sandelowski, 2013).

3.2. Case Study Analysis

Case study research is an empirical investigation that examines a modern phenomenon in its natural setting. It is especially appropriate for examining complex social phenomena whose boundaries with their context are not sharply defined (Runeson & Höst, 2008). In this study, case studies of 2-3 group housing projects will be undertaken to analyze the implementation and efficacy of the interaction design methods under consideration within the Design Thinking process. Case studies are useful when the practical knowledge is as vital as theoretical knowledge (Flyvbjerg, 2006). Case studies will assist in making sense of whether social designs shall be effective and the living conditions that support the possibility of taking structural opportunities (Deluca & Rosenblatt, 2010). A number of current group housing schemes shall be studied to obtain best practices and lessons learned. The case studies will be chosen from among those that offer innovative design aspects, community engagement strategies, and overall success in serving the requirements of their residents. Case study analysis shall include Studying architectural designs and the design documents. Analysing surveys and interviews of residents. Studying community governance and policies. Evaluating the sustainability and affordability of the schemes.

3.3. Participatory Action Research

PAR is a research strategy that focuses on the active participation of stakeholders within the process of research (Tabroni & Purnamasari, 2022). PAR seeks not only to produce knowledge but to also facilitate action and social transformation (Hays & Singh, 2012). By engaging residents, designers, and other stakeholders in the research process, PAR can make sure that the research is meaningful, relevant, and responsive to the priorities and needs of the community (Blair & Minkler, 2009). PAR with older adults can be an underdeveloped resource for the social gerontology field and for the elders as well (Blair & Minkler, 2009). In group housing, PAR can empower residents to engage in design and decision-making, resulting in more inclusive and sustainable housing solutions (Kapilashrami & Marsden, 2018). PAR may work through steps of religious values, attitudes, spirit doing, daily habits and some skills (Tabroni & Purnamasari, 2022). The PAR will include, Focus groups: Guided group discussions with a small number of prospective residents to discuss their views and opinions towards group housing. Online focus groups can be very effective for qualitative studies. Interviews: Individual discussions with people to have a better idea of their own experiences and insights. Surveys: Statistical questionnaires to get data in greater numbers and discern trends and patterns. Participatory design workshops: Group workshops where future residents collaborate with designers to design and critique design concepts.

3.4. Synthesis of Case Study Analysis and PAR

The combination of case study analysis and PAR enables a complementary method of understanding and streamlining the Design Thinking process for group housing. Case study analysis offers in-depth knowledge of how interaction design approaches are implemented within actual projects, while PAR guarantees that the research remains connected to the experiences and insights of the stakeholders (Elwood, 2009). This unification increases the collaboration and empowerment of stakeholders, in addition to the validity and applicability of the research outcomes (Sixsmith, J.,et al 2017).

4. Results and Findings

4.1. Case Study Analysis

This study analyzes four group housing developments in varied contexts—Italy, South Korea, the United States, and India to assess the ways in which Design Thinking (DT) and interaction design (IxD) (Brown & Wyatt, 2010) practices respond to socio-spatial issues. Through a convergence of user-centric principles with participatory and iterative methodologies, these case studies illustrate routes toward maximizing housing equity, sustainability, and community involvement. The comparative details are presented in Table 1.

4.1.1. Case Study 1: San Siro Neighborhood Revitalization, Milan, Italy

The San Siro public housing project in Milan, an iconic example of 20th-century Italian Modernist architecture, underwent redevelopment to address the dual challenges of socio-spatial inequality and deteriorating building infrastructure (Lucchi & Delera, 2020). The primary focus of the project was retrofitting for improved energy efficiency, while simultaneously fostering social cohesion within a multicultural and intergenerational community. The Design Thinking process was applied throughout the project, beginning with empathy-building through community workshops where residents actively participated in identifying their priorities, such as enhancing the safety of shared spaces and ensuring affordable energy solutions. Moving into the ideation phase, the collaborative efforts of residents and designers resulted in proposals such as modular green courtyards and solar-paneled rooftops. During the prototyping phase, small-scale initiatives like pop-up gardens were introduced to test the community's engagement with newly created green spaces. The testing phase revealed positive outcomes, with post-occupancy surveys indicating a 40% increase in the perceived safety of the neighborhood (Lucchi & Delera, 2020). Interaction Design methods were also employed, with wayfinding systems utilizing color-coded routes to assist older residents in navigating the area more comfortably, and mobile applications providing real-time channels for reporting maintenance needs. While the project successfully integrated both environmental and social sustainability elements, it faced limitations in maintaining scalable resident engagement, suggesting that future initiatives could benefit from more dynamic and continuous feedback loops facilitated by advanced interaction design approaches.

4.1.2. Case Study 2: Seoul, South Korea Public Apartment Housing (Yangnyeong Housing)

A comparative analysis of Design-Build (DB) and Design-Bid-Build (DBB) processes in large-scale public apartment housing projects revealed significant cost and time advantages associated with the DB approach (Park et al., 2015). Within the Design Thinking framework, stakeholder mapping played a crucial role in addressing communication gaps typically found between contractors and residents in DBB projects. The iterative prototyping process was notably enhanced in DB projects, where design teams utilized 3D modeling techniques to modify unit layouts in response to the varied needs of different family sizes. This approach fostered a culture of innovation, encouraging the adoption of advanced design and construction practices aimed at improving both efficiency and overall build quality. Collaboration among designers, contractors, and future residents was emphasized to ensure that the final outcomes reflected a balanced consideration of all stakeholder requirements. Interaction Design methods further strengthened this process, with the use of virtual

reality (VR) walkthroughs allowing residents to experience and customize their units before construction commenced. Additionally, community mobile applications enabled residents to participate in decision-making processes, such as voting on preferred communal amenities like gyms or childcare centers. The DB approach ultimately achieved measurable benefits, with a 15% reduction in overall costs and a 30% decrease in project delays (Park et al., 2015). However, the reliance on digital engagement tools highlighted an area of concern, as older residents often faced accessibility barriers due to the inflexible nature of high-tech solutions, underscoring the need for more inclusive, low-tech engagement options in future projects.

4.1.3. Case Study 3: Housing First Initiative, New York, USA

The Housing First initiative focused on providing permanent housing solutions coupled with trauma-informed support services for individuals experiencing homelessness, moving away from punitive policies that criminalized poverty and homelessness (Herring et al., 2019). The Design Thinking approach was integral to the project, beginning with the empathy phase, where in-depth interviews with individuals having lived experiences of homelessness informed key design decisions, such as incorporating private bathrooms within housing units to restore dignity and privacy. During the ideation phase, participatory sessions with residents led to the co-creation of community kitchens, which served to foster peer support networks and collective well-being. Interaction Design strategies were also implemented, with trauma-informed navigation principles guiding the inclusion of softer lighting schemes and clear, simplified signage to minimize anxiety triggers within communal spaces. Furthermore, digital service access points were integrated through in-unit tablets, allowing residents to easily connect with healthcare providers, vocational training, and other essential support services. The initiative yielded significant positive outcomes, with reports indicating a 60% improvement in residents' mental health status. Nevertheless, the project faced challenges related to long-term sustainability, as unstable funding streams limited the broader adoption of advanced Internet of Things (IoT) technologies that could have further enhanced resident engagement and service accessibility.

4.1.4. Case Study 4: Mahila Milan Cooperative Housing, Mumbai, India

In Mumbai, a women-led slum-dweller organization collaborated with non-governmental organizations to successfully construct over 15,000 low-cost housing units using a participatory design approach combined with micro-savings initiatives (SPARC, 2020). The application of Design Thinking was evident from the outset, particularly during the empathy phase, where grassroots workshops highlighted the residents' priorities, such as the incorporation of flood-resistant construction materials and the provision of dedicated childcare spaces within the housing design. Prototyping was approached through incremental home development, allowing families the flexibility to expand and modify their dwellings over time in alignment with their growing incomes. The project also made effective use of Interaction Design techniques, employing analog-digital hybrid systems, where traditional ledger boards tracking individual savings were progressively digitized through SMS notifications to improve accessibility and transparency. Additionally, simple icon-based community noticeboards were introduced to enable residents to crowdsource maintenance requests, making communication more inclusive, especially for those with limited literacy. The project achieved an impressive 92% resident satisfaction rate, reflecting its success in fostering community-driven housing solutions. However, persistent challenges remained, particularly concerning land tenure security, and the scalability of the model highlighted the need for stronger alignment between policy frameworks and interaction design interventions to ensure long-term sustainability and impact (Datta, 2015).

4.1.5. Case Study Comparative Analysis

Table 1 Comparative Analysis of Design Thinking and Interaction Design Across Case Studies

Aspect	San Siro	Seoul Apartments	Housing First	Mahila Milan
DT Stage Focus	Ideation & Testing	Prototyping	Empathy	Iterative Prototyping

IxD Tools	Feedback Apps	VR Models	Service Portals	Hybrid Ledgers
Sustainability	Environmental	Economic	Social	Socio-Environmental
User Engagement	High	Medium	Medium	High
Key Challenge	Scalability	Tech Accessibility	Funding	Land Rights

4.2. Research Analysis

This section consolidates insights from case studies and user research to present a structured understanding of how Design Thinking (DT) and Interaction Design (IxD) contribute to enhancing group housing projects. Through thematic analysis, comparative assessment, and integration of quantitative user inputs, the DT-IxD integration framework is established. The thematic analysis identifies three recurring challenges. First, the privacy versus community trade-off, where residents struggle to balance personal and shared spaces. In Milan's San Siro project, wayfinding systems and community participation enhanced safety and privacy; in New York's Housing First, private bathrooms promoted dignity; and in Mumbai's Mahila Milan, incremental home extensions allowed privacy customization. IxD solutions like modular layouts and feedback tools help resolve such trade-offs by enabling flexibility and participatory design. Second, sustainability in design and use emerged as a common theme, focusing on environmental, economic, and social integration. Seoul's public apartments used Design-Build for energy efficiency, San Siro applied retrofitting for energy savings and social cohesion, and Mahila Milan achieved low-cost housing through participatory micro-savings. This suggests sustainable design must equally address environmental and social goals through cost-effective, community-driven solutions. Third, user participation and feedback systems highlighted challenges in maintaining active engagement. Housing First showed positive impact through trauma-informed design but faced funding issues; Seoul used VR walkthroughs but struggled with accessibility for older residents; Mahila Milan used hybrid analog-digital noticeboards to broaden participation. This indicates IxD tools must combine low-tech and digital approaches to accommodate diverse user capacities and ensure inclusive, long-term engagement. Table 2 summarizes the key findings from the case study analysis.

4.2.1. Quantitative Insights from User Research

Table 2 Comparative Findings from Focus Groups and Surveys Further Validate Case Study Insights

Key Metric	Survey Finding (%)	Case Study Correlation
Privacy Preference	75% preferred semi-private communal spaces	Milan's modular courtyard approach
Sustainability Priority	70% ranked energy efficiency as a top concern	Seoul's DB model demonstrated cost-energy savings
Digital Accessibility	60% of older residents favored physical feedback systems	Mumbai's hybrid ledgers validated this preference
Community Engagement Tools	65% supported co-design platforms	NYC's service portals enhanced peer-to-peer interaction

4.3. Synthesis: Towards a DT-IxD Integration Framework

The synthesis highlights three core recommendations for improving group housing through Design Thinking (DT) and Interaction Design (IxD). First, empathy-driven IxD involves applying tools like trauma-informed wayfinding from New York City and hybrid ledger systems from Mumbai to promote inclusivity, while digital platforms such as Milan's mobile maintenance reporting help collect real-time resident feedback. Second, iterative policymaking focuses on aligning housing policies with DT-IxD cycles, as seen in Milan's participatory zoning and Seoul's iterative Design-Build refinements, ensuring continuous responsiveness to community needs. Third, scalable feedback systems recommend blending low-tech and high-tech tools, such as Seoul's VR walkthroughs paired

with community boards, or Mumbai's analog-digital hybrids, to bridge generational divides and broaden participation. Collectively, these findings establish a DT-IxD integration framework grounded in empathy-driven design, participatory policymaking, and inclusive feedback mechanisms to create adaptable and resident-centered group housing solutions.

5. Framework for Maximizing Design Thinking and Interaction Design

Grounded in the case study analysis and literature review, the following framework is presented to maximize Design Thinking and Interaction Design in the case of group housing:

5.1. Phase 1: Knowing the Users

Empathize: Conduct detailed user research to grasp the requirements, needs, desires, and anxieties of future residents. This could include focus groups [2], interviews, surveys, and participatory design workshops.

Define: Express the major challenges and opportunities of designing group housing that caters to the diverse needs of its inhabitants. This can include the development of user personas, journey maps, and problem statements.

5.2. Phase 2: Generating Design Concepts

Ideate: Create a large set of possible solutions for common areas, privacy, community governance, and other issues of group housing design. This can include brainstorming, sketching, and mood boarding.

Prototype: Develop physical representations of the solutions being suggested to test and iterate on them. This can include making physical models, computer mockups, and interactive prototypes. Low-fidelity prototypes are particularly helpful.

5.3. Phase 3: Refining and Evaluating Designs

Test: Test the prototypes with prospective residents to gain feedback and iterate on the design. This can include usability testing, A/B testing, and surveys.

Refine: Refine the design and develop a final design solution based on the feedback collected during the test phase.

5.4. Phase 4: Implementing and Monitoring

Implement: Put the design solution into practice in a real environment.

Monitor: Track the performance of the design solution and collect feedback from residents.

Iterate: Iterate on the design repeatedly based on the feedback collected during the monitoring process.

5.5. Key Considerations

Along with the above four phases, the following important considerations must be kept in mind while designing the project:

1. Community Governance: Create a fair, transparent, and inclusive community governance structure.
2. Privacy: Provide sufficient privacy to the residents in their personal living areas.
3. Shared Spaces: Make the shared spaces functional, comfortable, and beautiful.
4. Sustainability: Include sustainable design elements in order to minimize the environmental footprint of the project.
5. Affordability: Create affordable housing for varied income levels.
6. Accessibility: Design the housing such that it becomes accessible to those with disabilities. Taking advantage of campus accessibility may increase disability consciousness.
7. Flexibility: Create flexible and adaptable housing to suit diverse needs and ways of life.

8. Technology Integration: Integrate technology to enrich the living experience, e.g., smart home functions and community communication platforms. Internet of Things (IoT) technologies can be utilized in this regard.

6. Challenges and Opportunities

6.1. Challenges

Applying Design Thinking and Interaction Design in the context of group housing has some challenges

1. Diverse Needs: Group housing communities tend to include people with varied needs, preferences, and lifestyles.
2. Conflicting Priorities: Residents can have conflicting priorities for common spaces, privacy, and community management.
3. Budget Constraints: Group housing projects are usually on shoestring budgets, which can limit the extent of design innovation.
4. Community Engagement: Involving residents in the design process can be time-consuming and demand expert facilitation skills.
5. Measuring Success: Measuring the success of group housing schemes may be problematic because it consists of both objective and subjective criteria. Measuring the performance of the building in use can offer much insight.

6.2. Opportunities

Although these problems may exist, adopting Design Thinking and Interaction Design for group housing also offers a myriad of opportunities:

1. Improved User Experience: With understanding and consideration of the requirements of residents, designers can make group housing an effective and enriching living experience.
2. Community Building: Design Thinking and Interaction Design can be employed to create a high level of community and social interaction among the residents.
3. Innovation: These approaches can result in innovative design solutions that respond to the specific needs of group housing.
4. Sustainability: Group housing can be made more sustainable, minimizing its impact on the environment and encouraging responsible use of resources.
5. Affordability: Design Thinking and Interaction Design can be applied to make housing more affordable, thereby making group housing more accessible to more individuals.

7. Future Research Directions

The following areas need to be focused on in future research to better refine Design Thinking and Interaction Design for group housing:

1. Establishing standardized metrics to measure the success of group housing projects.
2. Designing best-practice guidelines for community participation in the design process.
3. Investigating the application of virtual reality and other technologies for prototyping and testing group housing designs.
4. Researching the long-term social, economic, and environmental effects of group housing.
5. Investigating the policy and regulatory framework for encouraging the creation of successful group housing communities.

8. Conclusion

Maximizing Design Thinking for group housing using interaction design techniques can result in more effective, user-focused, and eco-friendly living spaces. By learning about the aspirations and needs of prospective residents, designers are able to come up with creative solutions that work to

meet the specific challenges of communal living. This research paper has established a model for maximizing the design process and has made recommendations for establishing successful group housing communities. More research is needed to further streamline these methods and examine the long-term effects of group housing on people, society, and the environment.

The convergence of Design Thinking and Interaction Design provides an effective way to design group housing that not only satisfies the utilitarian requirements of its occupants but also develops a high level of community, supports social interaction, and improves overall well-being. By adopting such methods, architects, designers, developers, and residents can collaborate to design prosperous group housing communities that help make a more sustainable and equitable future.

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CRediT Authorship Contribution Statement

Tadiboina Samantha Kumar: Conceptualization, Methodology, Investigation, Writing – original draft, Writing – review & editing, Data curation, Formal analysis. Ramesh Srikonda: Supervision, Validation, Project administration, Writing – review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Data Availability

The data that support the findings of this study are available from the corresponding author upon request.

Ethics Committee Approval

This study did not involve experiments on humans or animals which require ethics committee approval. Informed consent was obtained from all interview and survey participants. Therefore, ethics committee approval was not required.

Resume

Tadiboina Samantha Kumar is a doctoral research scholar and assistant professor in Department of Architecture at the School of Planning and Architecture, Vijayawada, Andhra Pradesh, India. He holds a Bachelor's degree in Architecture from Jawaharlal Nehru Architecture and Fine Arts University, Hyderabad, and a Master's in Environmental Architecture from the Anna University, Chennai. He began his academic career as an Assistant Professor at the National Institute of Design, Andhra Pradesh, before pursuing his PhD. His current research focuses on optimizing the design thinking process for group housing through interaction design methods, with a broader interest in participatory design, sustainable housing models, and community engagement practices. He has contributed to design innovation projects, user-centered housing studies, and government-supported design research initiatives, reflecting a multidisciplinary approach towards housing design and policy development.

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