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From Smart Homes to Agentic Homes: AI Adoption in Age Friendly Housing

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Abstract

Rapid population ageing, coupled with accelerating urbanisation, has intensified the demand for housing systems that support independent living, health, and wellbeing in later life. Smart home technologies have long been proposed as a solution; however, existing approaches remain fragmented, largely reactive, and technologically deterministic. Recent advances in artificial intelligence (AI), particularly agentic systems and large language models (LLMs), enable a fundamental shift from smart homes—characterised by rulebased automation—towards agentic homes, defined by adaptive, autonomous, and humancentred intelligence. This paper develops a maturity model for AI adoption in agefriendly housing, conceptualising the transition from conventional smart homes to fully agentic homes. Using a structured literature review of more than 40 peerreviewed articles, policy reports, and institutional publications from 2022 to 2026, the study synthesises insights from housing studies, gerontology, AI research, and public policy. The proposed model identifies five levels of maturity—ranging from basic automation to ethically governed, learningbased agentic environments—and articulates the technological, organisational, and governance capabilities required at each stage. The findings demonstrate that agentic homes have the potential to transform ageinginplace by enabling continuous health monitoring, emotional support, preventative care, and systemlevel integration with public services. However, the transition requires careful attention to affordability, ethics, and governance, particularly in emerging and advanced economies facing divergent institutional capacities. The paper concludes by outlining implications for researchers, policymakers, and housing providers seeking to develop inclusive and sustainable housing futures for ageing populations.

Keywords: *Affordable Housing, Agentic Homes, Gerontology, Policy Making, Artificial Intelligence*

Introduction

Population ageing has emerged as one of the defining demographic transformations of the twentyfirst century. According to the United Nations, the number of people aged 65 years and above is projected to reach approximately 1.6 billion by 2050, with more than twothirds residing in urban areas (UN DESA, 2023). This demographic shift is occurring across both emerging and advanced economies, albeit at different speeds and with varying institutional preparedness (Warner et al., 2024; OECD, 2025).

Most of the existing urban housing stock has been designed for younger, familybased households and does not adequately support physical decline, cognitive change, or social isolation in later life (Harvard Joint Center for Housing Studies, 2023). In response, *smart homes* equipped

with sensors, automation, and Internet of Things (IoT) devices have been widely promoted as enablers of ageinginplace (Hu et al., 2024; Wang et al., 2024). Despite significant investment, smart home adoption in elderly housing remains uneven and often fails to scale beyond pilot projects (Hong et al., 2022; Khana et al., 2024). A central limitation is that most smart homes rely on rulebased automation, responding to predefined triggers rather than learning from residents' behaviours or adapting to changing needs. As a result, these systems remain reactive rather than anticipatory.

Recent advances in AI particularly agentic AI and large language models (LLMs) offer an opportunity to reimagine housing environments. Agentic AI systems can perceive context, reason over time, orchestrate multistep actions, and collaborate with humans, enabling homes that are not merely smart, but *agentic* (Abou Ali & Dornaika, 2025; Microsoft, 2026). This paper proposes a maturity model for AI adoption in agefriendly housing, providing a conceptual and practical roadmap for researchers, policymakers, and housing providers.

Literature Review

Age Friendly Housing and Ageingin Place

Ageinginplace refers to the ability of older adults to live safely, independently, and comfortably in their own homes and communities for as long as possible. Extensive research demonstrates that ageinginplace is associated with improved wellbeing, lower healthcare costs, and stronger social ties compared with institutional care (Hu et al., 2024; Pan et al., 2024).

Agefriendly housing emphasises accessibility, safety, adaptability, and proximity to services (WHO, 2022; OECD, 2025). However, physical design alone is insufficient to address the complex needs of ageing populations, particularly for individuals living alone or managing chronic conditions (Harvard Joint Center for Housing Studies, 2023).

Smart Homes for Older Adults

Smart homes integrate IoT devices, sensors, and automation to support daily living activities, monitor health, and enhance safety. Systematic reviews highlight benefits such as fall detection, medication reminders, and environmental control (Hu et al., 2024; Wang et al., 2024). Emotional companionship and social engagement features are increasingly explored, though evidence remains mixed (Wong et al., 2024).

Despite these advances, several limitations persist. Smart home systems are often:

- fragmented across vendors,
- difficult for older adults to customise,
- limited in their capacity to learn or adapt,
- heavily dependent on caregiver intervention (Khana et al., 2024; Gamble et al., 2024).

Emergence of Agentic AI

Agentic AI represents a shift from passive or assistive AI to systems capable of autonomous goaldirected behaviour. Recent surveys distinguish agentic systems by their ability to maintain state, plan actions, collaborate with humans, and learn over time (Abou Ali & Dornaika, 2025).

In enterprise and healthcare settings, agentic AI has demonstrated productivity gains and improved decisionmaking (McKinsey Global Institute, 2025; Microsoft, 2026). However, its application within residential housing particularly for ageing populations remains underconceptualised.

Governance and Ethics of AI in Homes

AI deployment in private homes raises profound ethical concerns, including surveillance, consent, data ownership, and trust. Unlike institutional settings, homes are intimate spaces where power asymmetries and cognitive decline can complicate consent (OECD, 2024; UN HighLevel Advisory Body on AI, 2023).

Existing AI governance frameworks rarely address domestic contexts explicitly, creating regulatory blind spots for housingbased AI systems (OECD, 2025; Nature, 2026).

Methodology

This study employs a structured literature review, following established guidance for integrative

and policyoriented reviews (PRISMA principles adapted for qualitative synthesis).

Data Sources

Literature was collected from:

- peerreviewed journals (MDPI, Springer, Nature, Oxford Academic, IEEE, JMIR),
- AI and housing white papers (McKinsey, Microsoft),
- institutional reports (UN DESA, OECD, UN-Habitat).

Selection Criteria

Inclusion criteria:

- published between 2022 and 2026,
- focused on ageing, housing, smart homes, AI agents, or governance,
- peerreviewed or published by recognised organisations.

A total of 46 sources met the criteria and were synthesised thematically.

Analytical Approach

The literature was coded across four dimensions:

1. Technological capability
2. HumanAI interaction
3. Governance and ethics
4. Housing system integration

These dimensions informed the development of the maturity model.

Limitation of Methodology

This study is subject to several methodological limitations that should be acknowledged when interpreting its findings. First, the proposed maturity model for AI adoption in age-friendly housing is derived exclusively from a structured literature review and does not incorporate empirical testing or validation. Given ongoing concerns related to governance, ethics, data protection, and accountability, large-scale real-world implementation of highly autonomous AI agents in domestic settings—particularly for ageing populations—remains limited (OECD, 2025; UN High-Level Advisory Body on AI, 2023). Consequently, empirical validation of fully agentic homes is premature, and the model should be interpreted as a conceptual and agenda-setting framework. Second, while the literature review followed transparent inclusion criteria and synthesised 46 recent peer-reviewed and institutional sources, it does not constitute a full systematic review under PRISMA guidelines. The absence of a PRISMA flow diagram, inter-rater reliability measures, and formal sensitivity analysis introduces potential selection and interpretive bias (Hu et al., 2024; Wong et al., 2024). In addition, limitations related to database coverage, search string formulation, and the exclusion of non-English and emerging grey literature may affect completeness.

Discussion: A Maturity Model for Agentic Homes

Rethinking Smart Homes as Socio-Technical Systems

Most early smart home deployments focused on discrete functionalities such as motion sensing, environmental control, or emergency alerts without sufficient consideration of how these technologies interact with users' evolving physical, cognitive, and emotional states over time (Hu et al., 2024; Khana et al., 2024). This narrow framing has limited both adoption and sustained impact, particularly among older adults living alone. By contrast, agentic homes require a systemic perspective in which housing environments are understood as dynamic ecosystems involving residents, caregivers, AI agents, service providers, and governance institutions.

Research in gerontology and human–computer interaction indicates that older adults' needs are non-linear and context-dependent, shaped by health trajectories, social relationships, and environmental stressors (Pan et al., 2024; Wang et al., 2024). A maturity model is therefore essential to differentiate incremental technological upgrades from genuinely transformative shifts in housing intelligence.

The proposed maturity model addresses this gap by situating AI capabilities within broader housing and care systems, rather than treating them

as isolated add-ons. This approach aligns with recent calls to move beyond "technology-first" narratives towards capability-based and outcome-oriented frameworks in smart city and housing research (OECD, 2025; McKinsey Global Institute, 2025).

Deepening the Five Levels of AI Maturity in Housing

At Level 1 (Automated Homes), housing intelligence is limited to deterministic rules triggered by sensor inputs. While such systems can improve convenience and basic safety, they lack adaptability and offer minimal support for complex ageing-related challenges (Khana et al., 2024; Hu et al., 2024). Importantly, evidence suggests that older adults often disengage from these systems due to false alarms, rigid logic, or poor usability.

Level 2 (Sensor-Aware Homes) represents a quantitative improvement through richer data collection, including physiological and behavioural metrics. However, the literature highlights a persistent "interpretation gap": data are collected continuously but meaning-making remains externalised to caregivers or clinicians (Wang et al., 2024; Gamble et al., 2024). This model risks increasing surveillance without proportional gains in autonomy or well-being.

The transition to Level 3 (Context-Aware Smart Homes) marks a qualitative shift. Machine-learning models enable pattern recognition and personalised responses, allowing systems to infer deviations from baseline behaviour. Yet, studies indicate that these systems remain largely reactive and domain-specific, with limited cross-functional coordination (Hu et al., 2024; Hong et al., 2022). As a result, benefits are often fragmented across health, safety, and comfort domains.

Level 4 (Agent-Assisted Homes) introduces conversational and task-oriented AI agents capable of mediating between residents, devices, and services. Evidence from long-term care and assisted living contexts suggests that such agents can reduce caregiver burden, improve medication adherence, and mitigate loneliness when designed with user-centred principles (Wong et al., 2024; Microsoft, 2026). However, human-in-the-loop oversight remains essential to maintain trust and prevent over-automation.

At Level 5 (Fully Agentic Homes), housing environments function as learning systems capable of long-term adaptation, ethical self-monitoring, and integration with public infrastructure. This level aligns with emerging visions of agentic AI in real estate and healthcare, where agents orchestrate multi-step decisions while respecting governance constraints (Abou Ali & Dornaika, 2025; OECD, 2025). Importantly, this maturity level reframes autonomy not as technological independence, but as supported agency for ageing residents.

Fig. 1: 5 Levels of AI Maturity in Housing

Governance, Trust, and Ethical Maturity

A key contribution of the maturity model is its explicit recognition that ethical and governance capabilities mature alongside technical capabilities. The literature consistently warns that advanced AI systems in private homes amplify risks related to surveillance, consent, and power asymmetries particularly for cognitively vulnerable populations (UN High-Level Advisory Body on AI, 2023; OECD, 2024).

Lower maturity levels often lack transparent data practices or meaningful consent mechanisms, undermining trust and long-term adoption. By contrast, higher-maturity agentic homes embed governance features such as explainability, user override, and accountability by design (Nature, 2026). This mirrors findings from public-sector AI research, which emphasises that trustworthiness is a precondition for scale rather than an outcome of deployment (OECD, 2025).

Crucially, governance maturity must be understood as a housing system attribute, not merely a software feature. Effective agentic homes require alignment between housing providers, regulators, healthcare systems, and technology vendors—an insight that reinforces the value of a staged maturity framework.

Implications for Age-Friendly Housing Futures

The expanded analysis underscores that the transition from smart to agentic homes is not inevitable nor purely technological. It is contingent on institutional readiness, affordability, and inclusive design. Without deliberate policy intervention, there is a risk that high-maturity agentic homes become accessible only to affluent households, exacerbating inequality in ageing outcomes (Harvard Joint Center for Housing Studies, 2023; OECD, 2025).

By articulating discrete maturity levels, the model enables policymakers and housing providers to identify appropriate rather than maximal AI adoption pathways. In this sense, the maturity model functions not only as an analytical tool but as a strategic planning instrument for developing age-friendly housing futures that balance innovation with equity**.**

Conclusion

This paper has advanced the concept of *agentic homes* as the next stage in agefriendly housing innovation. By proposing a maturity model for AI adoption, it provides a structured pathway for transitioning from fragmented smart home systems to integrated, humancentred agentic environments.

The findings suggest that agentic homes can significantly enhance ageinginplace, reduce care burdens, and support emotional well-being for the ageing population. It aims to provide a conceptual framework for advancing smart home models to AI-enabled, agentic-supported homes for the ageing population. However, realising this potential requires coordinated investment, ethical governance, and inclusive design. We would like to recommend future research empirically test the model across cultural and economic contexts.

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