AISC 2023

3rd CONFERENCE ON ASIAN INCLUSIVE SMART CITIES

IN THE POST COVID-19 ARENA

MALAYSIA'S PERSPECTIVES ON INCLUSIVENESS ON SMART CITIES

14 – 15 NOVEMBER 2023

Edited by:

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3rd CONFERENCE ON ASIAN INCLUSIVE SMART CITIES (AISC) 2023:

MALAYSIA'S PERSPECTIVES ON

INCLUSIVENESS IN SMART CITIES

The 3rd AISC is organized as part of the commemorative initiatives for the 50th Year of ASEAN-Japan Friendship and Cooperation under the auspices of the Ministry of Foreign Affairs of Japan.

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SYNOPSIS

The 3rd Conference on Asian Inclusive Smart Cities (AISC) 2023 brought together policymakers, researchers, industry experts, and urban planners to explore Malaysia's strategies for developing inclusive smart cities. The event, themed "Malaysia's Perspectives on Inclusiveness in Smart Cities", highlighted the critical balance between technological innovation and social equity in urban development.

Key topics included integrating cutting-edge technology with community-centric approaches, enhancing accessibility for all demographics, and addressing urban challenges such as mobility, sustainability, and housing. Through panel discussions and workshops, participants examined case studies of successful smart city initiatives in Malaysia and Asia, focusing on inclusivity, cultural sensitivity, and environmental stewardship.

The conference fostered collaboration and knowledge-sharing, promoting actionable frameworks to advance Malaysia's position as a leader in inclusive smart city development

PROCEEDINGS: 3rd Conference on ASIAN INCLUSIVE SMART CITIES (AISC) 2023

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Welcome to the 3rd Conference on Asian Inclusive Smart Cities in the Post Covid-19 Arena: Malaysia's Perspectives on Inclusiveness in Smart Cities

Dean of IIUM Academy
IIUM Academy of Graduates and Professional Studies
Assoc. Prof. Dr. Badri Najib bin Zubir

It is with great pleasure that I extend my warmest greetings to all participants of the 3rd Conference on Asian Inclusive Smart Cities (AISC) 2023, themed "Malaysia's Perspectives on Inclusiveness in Smart Cities."

This conference serves as a vital platform for exchanging innovative ideas, fostering meaningful collaborations, and addressing the pressing challenges of urban development in the modern era. At IIUM Academy, we are committed to championing inclusivity and sustainability as key pillars of academic and professional excellence. Hosting this conference aligns with our mission to nurture intellectual discourse that contributes to the betterment of society, particularly in advancing equitable and accessible urban ecosystems.

The theme for this year's conference is particularly significant as Malaysia and other Asian nations strive to balance technological advancements with inclusivity, ensuring that no one is left behind in the pursuit of progress. I am confident that the discussions and insights shared during this event will pave the way for transformative approaches in smart city development, emphasizing equity, sustainability, and resilience.

On behalf of IIUM Academy, I would like to express my gratitude to the organizing committee, keynote speakers, participants, and partners who have contributed to making this event a success. May this conference inspire us all to work collectively toward creating smart cities that truly reflect the ideals of inclusivity and innovation.

Thank you, and I wish you all a fruitful and enlightening experience.

Welcome to the 3rd Conference on Asian Inclusive Smart Cities in the Post Covid-19 Arena: Malaysia's Perspectives on Inclusiveness on Smart Cities

Collaborative Research Chair for Asian Business Leader Development
Graduate School of Management, Kyoto University
Kiyoshi KOBAYASHI and Emi TOHYAMA

This proceedings volume presents a collection of pivotal papers exploring key insights and approaches to inclusive smart cities in the Malaysian context, as discussed at the 3rd International Conference of Asian Inclusive Smart Cities (AISC Conference), titled "Malaysia's Perspectives on Inclusiveness in Smart Cities." The conference, held on November 14–15, 2023, was jointly organized by the International Islamic University Malaysia (IIUM) and the Graduate School of Management, Kyoto University (GSMKU).

The AISC Conference series represents a core initiative of the extensive international network spearheaded and organized by the Collaborative Research Chair for Asian Business Leader Development (ABL Project[1]) at the Graduate School of Management, Kyoto University. As the primary organizer, the ABL Project leads this network of 25 research institutions across 10 Asian countries, fostering collaboration to address urban challenges in the ASEAN region by promoting

[1] The Collaborative Research Chair for Asian Business Leader Development (ABL Project) was established in 2013 through a partnership between the Graduate School of Management, Kyoto University, and the Kyoto Business Research Center (KBRC). The ABL Project aims to cultivate human resources capable of driving business expansion and new venture creation in Asia. Each year, employees from leading Japanese companies participate as research fellows in the program. The project collaborates with top universities across Asia, inviting a diverse group of lecturers, including faculty from local universities and executives from local businesses, to conduct lectures and workshops. Furthermore, participants gain practical skills through medium- to long-term internships in the ASEAN region, providing them with opportunities to immerse themselves in local business environments and develop hands-on expertise.

shared understanding of smart cities through citizen-led approaches and social inclusion. It began with the inaugural online conference in November 2021, co-hosted with the University of Economics Ho Chi Minh City, followed by a second online event in May 2022 in partnership with the University of Indonesia. This third iteration marked a significant milestone as it transitioned to an in-person format for the first time, hosted in Malaysia.

The successful realization of the 3rd International Conference was made possible through the invaluable support of Professor Tan Sri Dato' Dzulkifli Abdul Razak, Rector of IIUM. This event also commemorated IIUM's 40th anniversary, underscoring its importance in fostering academic and societal collaboration. Furthermore, the conference was conducted as part of the *50th Year of ASEAN-Japan Friendship and Cooperation* initiative, highlighting its broader significance in promoting regional collaboration and inclusivity.

The first day featured keynote speeches by distinguished guests, including His Excellency Katsuhiko Takahashi, Ambassador of Japan to Malaysia; Dr. Zaini Ujang, former Secretary General of the Ministry of Energy, Green Technology, and Water, Malaysia, and current Secretary General of the Ministry of Health, Malaysia; Professor Hans Westlund, President of the Regional Science Association International (RSAI) and Professor of KTH Royal Institute of Technology, Sweden; and Professor Kiyoshi Kobayashi, Professor Emeritus of Kyoto University. These addresses examined critical themes such as globalization, the impacts of COVID-19, and advancements in digital transformation, offering insights into the future of regional communities in a post-pandemic era. In addition to the keynote sessions, the program featured a panel discussion led by Professor Zainal Abidin Sanusi, Director of the Sejahtera Centre for Sustainability and Humanity at IIUM. The panel included representatives from academia, industry, and government, who engaged in a robust dialogue on people-centric smart city governance and strategies for realizing inclusive societies. On the second day, the program included keynote addresses by the Head of the Smart City Unit from PLANMalaysia (Federal Department of Town and Country Planning) under the Ministry of Housing and Local Government, as well as a representative from JETRO Malaysia. In the afternoon, researchers from Malaysia, Japan, and other countries presented their studies, fostering a dynamic exchange of ideas and perspectives on inclusive smart city development.

This section provides an opportunity to contextualize the inception of the AISC Conference series. The COVID-19 pandemic, which emerged in 2020, brought an unprecedented stillness to streets worldwide—a stark and unforgettable image. While public spaces were devoid of people, the flow of goods and essential services had to continue without interruption. The sustained operation of critical sectors such as healthcare, logistics, manufacturing, and services, deeply rooted in the physical world, was indispensable for maintaining societal systems. The pandemic also acted as a catalyst for the rapid global adoption of telework and online meetings, heralding a transformative moment aptly described as an "online revolution". This historic shift fundamentally altered societal functions, enabling continuity across various domains despite widespread physical restrictions. Had the pandemic occurred a decade earlier, it might have resulted in catastrophic stagnation of global socio-economic systems.

Recent advancements in IT technology have significantly enhanced virtual communication modes, leading to the development of a hybrid world where the physical and virtual realms intersect. The spread of COVID-19 exemplified the "Small-world network principle," a concept that underpins human communication in real-world interactions. This same principle governs the dissemination of business ideas and knowledge, reflecting analogous network dynamics. In physical environments, small groups or clusters naturally form, whether in communities, workplaces, or even leisure classes. These clusters facilitate the internal exchange of information while enabling knowledge to diffuse beyond their immediate boundaries to broader networks. Furthermore, through extensive human connections, this diffusion extends to remote regions. Whether it involves the transmission of a virus or the propagation of knowledge, societal diffusion relies on human networks, ultimately influencing the entire social fabric.

Online communication platforms have significantly broadened the reach of these networks, enabling the seamless sharing of knowledge on a global scale. On-demand communication technologies have effectively mitigated temporal constraints, allowing individuals to participate at their convenience. This hybrid communication model, integrating physical and virtual interactions, has substantially reduced time-related limitations. The hybridization of communication, accelerated by the pandemic, constitutes not only a profound transformation in

human connectivity but also a distinctive opportunity to innovate new lifestyles and business models.

While discussions of a 100-year lifespan have gained prominence, the number of hours in a day remains constant. Nevertheless, modern life has undeniably become more demanding. Considerable time is spent browsing the internet on smartphones and engaging in social media and other online communication platforms. The accelerated obsolescence of knowledge and skills has necessitated the continual acquisition of new IT competencies. Furthermore, the diversification of values and evolving family and societal structures have required individuals to invest additional time in acquiring knowledge and skills essential for adapting to new modes of living. The daily activities of individuals are typically distributed across various domains, including work, leisure (encompassing meals), household chores, childcare, caregiving, and commuting. As modern life becomes increasingly fast-paced, individuals face mounting time pressures. To address this challenge, the rationalization and outsourcing of feasible tasks have become essential. Advances in big data and artificial intelligence (AI) technologies have rendered such rationalization economically viable. While each instance of optimization may appear minor, their cumulative impact across multiple domains enables individuals to reclaim time for leisure and learning, thereby alleviating time-related constraints.

Nonetheless, certain human activities, particularly those involving learning and leisure, are inherently resistant to outsourcing. These activities thrive within well-designed urban spaces, which facilitate participation in cultural or educational pursuits, the enjoyment of meals in enriching environments, and meaningful interactions with trusted companions. Such activities constitute fundamental aspects of human life. While traditional urban activities, such as shopping and commuting to work, are unlikely to lose their relevance entirely, their importance in future urban societies is expected to diminish gradually.

In the context of post-pandemic society, the rapid proliferation of generative AI technologies, exemplified by tools such as ChatGPT, has introduced profound social and economic transformations. These technologies enable instantaneous access to and processing of globally available big data, facilitating the collection and synthesis of knowledge and information in real

time. This development can be described as a contemporaneous average-value operation. Over time, repeated queries and the aggregation of generative AI outputs (corpus) will form a temporal body of knowledge that offers opportunities for longitudinal analysis. This evolution is likely to give rise to a new academic field centered on historical trend analysis derived from AI-generated responses. Moreover, the development and management of such databases are poised to emerge as a significant industry. This emerging domain, which may be termed "meta-generative AI" is expected to give rise to diachronic databases—datasets spanning extended time periods—that facilitate the analysis of trends and changes. These databases will not only support academic research but also open vast opportunities for innovation and business development in the data-driven economies of the future.

Generative AI possesses the capacity to represent standard models within the realm of logic. When a problem is appropriately posed, it can effortlessly generate a contemporaneous standard model. Historically, researchers and practitioners have invested considerable time and effort in reconstructing such models. Generative AI now enables these models to be generated instantaneously and at minimal cost, effectively introducing a universal benchmark—the standard model—to global use. This development signifies an unprecedented revolution in human history. Simultaneously, it diminishes the traditional value of standard models, which once held significant prominence in fields such as consulting. In this emerging paradigm, research and business activities are increasingly defined by the extent to which they diverge from the standard models provided by generative AI. Regional and cultural uniqueness, along with context-specific approaches, are becoming the primary sources of added value.

Generative AI can provide benchmarks for assessing creativity but cannot serve as the originator of genuine originality. This transformation has profound implications for higher education. Traditional classroom lectures, historically defined by the delivery of structured instruction and exercises, are now being compelled to undergo fundamental reform. To cultivate creativity, the importance of in-person interactions with exceptional educators has become more significant than ever.

To contribute to the well-being of people in Asia, it is imperative to move beyond innovation models centered on standardization and instead develop inclusive innovation models that are grounded in human realities. Unlike the winner-takes-all networks exemplified by innovation hubs, it is crucial for Asian companies participating in corporate ecosystems (platforms) to enhance the overall economic value of these platforms through "co-creation innovation." By doing so, they can play a pivotal role in fostering societal well-being. This approach aligns closely with the principles of the Asian version of the Sustainable Development Goals (SDGs) and Environmental, Social, and Governance (ESG) investment, making it widely acceptable within Asian societies, including ASEAN nations. Across Asia, fostering startups and supporting the growth of small and medium-sized enterprises (SMEs) have emerged as national priorities. Reflecting this, many top universities within the Asian Business Leader (ABL) network have established startup centers and innovation hubs. However, the increasingly intense competition from well-funded and resource-rich Western universities, which actively recruit promising innovators, presents significant challenges for Asian universities in their efforts to nurture local startups. Consequently, the success rates of startups supported by university-led innovation platforms remain low. Many talented individuals, promising entrepreneurial ventures, and substantial ideas and funds fail to achieve their potential, ultimately disappearing from the market.

To address these challenges, the ABL Project has aimed to establish an industry-government-academia collaboration platform known as the Co-creation Asian Innovation Platform Network. This platform is spearheaded by Asia's top universities in collaboration with Japanese and Asian companies, as well as governmental entities in the respective target countries. It aspires to foster "convivial" innovation, emphasizing collaborative creation where all participants contribute to and benefit from the innovation process in a mutually advantageous, win-win manner. Over the past decade, the ABL Project has demonstrated the feasibility of building such platforms by leveraging academia as a mediator to facilitate collaboration among industry, government, and academia. The primary objective of this platform is to foster mutual understanding and enable meaningful interactions between potential business partners—including startups—and stakeholders across various sectors. By promoting these interactions, the Co-creation Asian Innovation Platform Network seeks to nurture sustainable innovation ecosystems that drive economic growth and enhance shared prosperity across the region.

Under the comprehensive framework of the ABL Project Platform, the AISC (Asian Inclusive Smart Cities) Conference Series was established as part of the Asia Network to share insights from industry, government, and academia on the vision and policies required to realize inclusive smart cities in Asia. Since its inception in 2021, this series has consistently provided a platform for international dialogue, promoting discussions aimed at achieving inclusive smart cities across Asian countries. As previously noted, this series does not solely focus on developing standardized theories of inclusive smart cities. Asia is a region of extraordinary diversity, and its cities reflect this richness. In 2023, the 3rd AISC Conference, held in Malaysia, delved deeply into the unique context of inclusive smart cities within the Malaysian framework. The conference sought to explore and articulate multifaceted and enriched perspectives specific to Malaysia. This approach has culminated in a viewpoint aptly termed "Malaysia's Perspective" on inclusive smart cities in Asia.

In concluding this preface, we would like to extend our heartfelt gratitude to the International Islamic University Malaysia and Kyoto University for their invaluable efforts in preparing and realizing this international conference. We are also deeply appreciative of the intellectual support provided by the Economic Research Institute for ASEAN and East Asia (ERIA). The central concept of people-centricity, which serves as the foundation of this conference, would not have emerged without collaboration with ERIA.

Lastly, we wish to express our profound gratitude to the Collaborative Research Chair for Asian Business Leader Development, part of the Graduate School of Management at Kyoto University, as well as the International Mega Infrastructure Management Policy Chair, generously endowed by Yachiyo Engineering Co., Ltd., and ERIA. Their indispensable contributions, both human and financial, were vital to the successful realization of this international conference.

MESSAGE FROM EDITORIAL TEAM

Dear Readers,

We are delighted to present the proceedings of the **3rd Conference on Asian Inclusive Smart Cities in the Post-COVID-19 Arena: Malaysia's Perspectives on Inclusiveness in Smart Cities**. This publication represents a rich compilation of research, ideas, and discussions centered on the dynamic and evolving landscape of smart cities, with a particular focus on inclusiveness in Malaysia and across Asia in the post-pandemic context.

The COVID-19 pandemic has profoundly impacted urban development and exposed vulnerabilities while also offering opportunities to rethink and reshape cities to be more inclusive, resilient, and sustainable. This conference provided a platform for researchers, policymakers, practitioners, and thought leaders to come together and share innovative approaches and solutions that prioritize inclusivity in the development of smart cities. The contributions in this volume address critical issues such as leveraging digital technologies for equitable access to urban services, strategies for bridging the digital divide in underserved communities, urban planning innovations that promote inclusivity and accessibility, policy frameworks supporting inclusive smart city development, and lessons learned from Malaysia and other Asian nations in navigating the post-COVID-19 urban landscape.

As the editorial team, we are proud to have curated a diverse range of perspectives and extend our deepest gratitude to the authors for their valuable contributions, the reviewers for their meticulous assessments, and the organizing committee for their tireless efforts in ensuring the success of this conference. Their collective dedication has enriched these proceedings and advanced the discourse on inclusive smart cities in the region.

We hope this collection of papers will serve as a valuable resource for researchers, practitioners, and policymakers, inspiring further innovation and collaboration in building inclusive smart cities that leave no one behind. Thank you for your continued support, and we look forward to seeing the insights from this conference translated into meaningful actions for a more inclusive urban future.

Warm regards,
The Editorial Team
Proceedings of the **3rd** Conference on Asian Inclusive Smart Cities

KEYNOTE SPEAKERS

1) YBhg. Dato' Seri Ir. Dr. Zaini Bin Ujang, *Secretary General, Ministry of Health, Malaysia*
2) Professor Kiyoshi Kobayashi, *Professor Emeritus, Kyoto University*
3) YBrs. TPr. Dr. Alias Bin Rameli, *Director General of PLANMalaysia, Ministry of Local Government Development*
4) Terence Kok, *Technical Director, Meinhardt Group*
5) Prof. Dato' Sri Ar. Dr. Asiah Abdul Rahim, *Professor, Kulliyyah of Architecture and Environmental Design, International Islamic University Malaysia (IIUM)*
6) Prof. Ir. Dr. Siti Fauziah Toha, *Deputy Director, IIUM Academy and Professor of Artificial Intelligence, Kulliyyah of Engineering International Islamic University Malaysia*
7) Prof. Dr. Zainal Abidin Sanusi, *Director, Sejahtera Centre for Sustainability and Humanity, International Islamic University Malaysia (IIUM)*
8) Tpr. Hj. Nik Mohd Ruiz Ahmad Fakhrul Razy, *Council Member, Malaysia Institute of Planner*
9) Prof. Hans Westlund, *President Regional Science Association International, Sweden*
10) Mr. Ts. Md. Farabi Yussoff, Head Smart City Unit, *Department of Town and Country Planning, Ministry of Local Government Development*


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Prof. Hans Westlund


Mr. Ts. Md. Farabi Yussoff

PROGRAM ITINERARY

3rd Conference on Asian Inclusive Smart Cities (AISC) 2023

Date: 14 - 15 November 2023

PROGRAMME SCHEDULE

DAY 1 : 14 NOVEMBER (TUESDAY)

9:00 – 9:10	**Introduction by Emeritus Prof. Tan Sri Dato' Dzulkifli Razak,** Rector of International Islamic University Malaysia (IIUM)
9:10 – 9:30	**Welcoming Speech by Representative of Japanese Embassy in Malaysia**
9:30 – 10:00	Keynote speech by **YBhg. Dato' Seri Ir. Dr. Zaini Ujang,** Secretary General, Ministry of Human Resources, Malaysia
10:00 – 10:30	**Photo Session & Tea Break**
10:30 – 11:00	Keynote speech by **Prof. Hans Westlund,** President, Regional Science Association International, Sweden
11:00 – 11:30	Keynote speech by **Prof. Dato' Sri Ar. Dr. Asiah Binti Abdul Rahim,** Professor, Kulliyyah (Faculty) of Architecture, IIUM
11.30 – 12:00	Keynote speech by **Prof. Kiyoshi Kobayashi,** Professor, Kyoto University, Japan
12:00 – 12:30	Keynote speech by **YBrs. TPr Dr. Alias bin Rameli,** Director General of Town and Country Planning Ministry of Local Government Development
12:30 – 14.15	**Networking Lunch & Prayer**
14:15 – 15:45	Panel Discussion (Industry) **Facilitator:** **Assoc. Prof. Dr. Zainal Abidin Sanusi** Director, Sejahtera Centre for Sustainability and Humanity, IIUM **Panelists:** 1. **YBhg. Datuk Seri Haji Hasnol Zam Zam Haji Ahmad**, Secretary General of the Ministry of Works 2. from Hakuhodo or Mitsui Real Estate Company 3. **Prof. Osamu Fujiki**, Kyoto University 4. **Mr. Fumitaka Machida**, Senior Fellow ERIA
15:45 – 16:15	**Coffee/Tea break**
16:15 – 16:55	Keynote speech by **Mr. Omar Shahzad,** Group CEO of the Meinhardt Group
16:55 – 17:35	Keynote speech by **Prof. Ir. Dr. Siti Fauziah Toha,** Professor, Kulliyyah (Faculty) of Engineering, IIUM
17:45 – 19:30	**Break**
19.30 – 21:30	**Networking Dinner**

---------- ***End of day 1*** ----------

PROGRAMME SCHEDULE

DAY 2 : 15 NOVEMBER (WEDNESDAY)

9:00 - 9:05	Day 2 Opening Speech by **Prof. Kiyoshi Kobayashi,** Professor, Kyoto University, Japan
9:05 - 9:35	Keynote speech by **Representative of Jetro Malaysia**
9:35- 10:30	Keynote speech by **Mr TPr Nik Ruiz Razy,** Council Member, Malaysia Institute of Planner with co-speaker **Mr. Ts. Md. Farabi Yussoff,** Head Smart City Unit, Department of Town and Country Planning Malaysia, Ministry of Local Government Development
10:30 - 10:45	**Coffee/Tea Break**
10:45 - 11:15	**Paper Presentation Session 1**
11:15 - 11:45	**Paper Presentation Session 2**
11:45 - 12:30	**Paper Presentation Session 3**
12:30 - 13.45	Networking Lunch & Prayer
13:45 - 14:15	**Paper Presentation Session 4**
14:15 - 14:45	**Paper Presentation Session 5**
14:45 - 15:15	**Paper Presentation Session 6**
15:15 - 15:30	**Coffee/Tea Break**
15:30 - 16:15	**Paper Presentation Session 7**
16:15 - 16:45	**Paper Presentation Session 8**
16.45 - 17:15	Closing Ceremony

---------- *End of day 2* ----------

TABLE OF CONTENTS

Awareness Of Smart Home Interior In Malaysia: A Systematic Review

Arita Hanim Awang[1*], Nor Hafiza Binti Halim[1], Nurlelawati Ab Jalil[1], Syakir Amir Ab. Rahman[1], Norzailawati Mohd. Noor[1], Abdul Razak Sapian[1], Norfazillah Ahmad[2]

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ABSTRACT

Home has always been a place of relaxation, refuge, and sanctuary offering relief from the world's busyness and intrusiveness. As the home becomes an important place for all as their place of rest, a smart home has been introduced as a place full of functionality. In the past, smart homes were considered part of a lavish lifestyle but have become an integral part of our lives today. But nowadays, it has become dominant as it is important in creating comfort, energy-saving, security, and efficiency. In this paper, the study will focus on the level of awareness regarding the smart home in Malaysia by using a systematic review. The systematic review presents an overview of ideas to specifically address and enable one or more designated research questions in the availability of potentially relevant studies. For accurate papers in an electronic search engine, it requires proper evaluation of the databases and keywords.

Keywords: Systematic literature review, smart home, house interior, Malaysia.

Introduction

This article addressed the use of systematic analysis of literature to describe smart home interiors in Malaysia from current papers on a database. The term smart home can be defined as "an application of ubiquitous computing in which ambient intelligence monitors the home environment to provide context-aware services and to facilitate remote home control" (Alam et al., 2018)[1]. Lighting, security, temperature, appliances, entertainment and phone set-up are several smart home features nowadays. Even though, there are several features of smart home but some of them still unaware to the smart home. According to Rasyidah et al. [2], there have been cases within the smart home market where potential home buyers may be unaware of the

technology, thus hindering its acceptance and further growth. Other than that, the only concern now is the devices' viability of providing complete power, which could have added up to short term costing for different devices install (Ahmad Mahmud et al., 2020)[3]. Somehow, cost on producing the smart home can influence the people surrounding on the implement it into their houses. Therefore, this article aims to draw on the preceding papers to systematically assess if Malaysian was aware of the smart home 's interior and how many publications were published.

Literature Review

Housing one of the most significant elements of life which provides shelter, safety and warmth as well as a place to rest. The need for accommodation is not only one of the essential human elements but also a measure of the population's living conditions (Henilane, 2016)[4]. In recent years, the idea of a smart home has been greatly developed to promote self-care at home (Rasyidah et al., 2020)[2]. According to Alam et al. [1], “Smart homes are a part of ubiquitous computing that includes integrating smartness into homes for convenience, health, safety , security and energy conservation’. Other than that, the smart home idea is often referred to as the adaptation of smart grid technologies to residential building typology (Ahmad Mahmud et al., 2020)[3]. Furthermore, Fabi et al. [5] also said the detection of clinical issues, entertainment, security and energy efficiency were the key services offered by smart homes.

As stated by Sripan et al. [6], smart home technology also can be classified into the smart home network, smart home controller and also home automation. Integrating IoT with Online providers and cloud storage is also part of the smart home concept (Soliman et al., 2013)[7]. Wireless Sensor Networks (WSNs) is also another smart home device capable of avoiding electrical pollution, saving human resources and, at the same time, enhancing the quality of life of elderly people (Nisar et al., 2017)[8]. Altogether, smart homes will achieve huge interest in the future and recent developments show that they are becoming the hub of smart utility use (Alam et al., 2018)[1].

Methodology

The research method included peer-reviewed reviews and articles from Malaysia, and international article and journal publications published after 2010. The systematic analysis of literature intended to systematically detail past literatures relating to Malaysia's smart home interior. It relates to a level of concern about this smart home from residential residents, designers and suppliers.

3.1 Search Process

Searching process is a significant thing for findings in the literature. The literature findings are useful in the comprehension and contrasting of the researchers' knowledge. Abstracts and keywords are mainly viewed in this study for the identification of research studies regarding the smart home interior in Malaysia. The main significance is to highlight on the article published from Malaysia in regards of smart home. In total six databases in four keywords have been thoroughly investigated.

Table 1: List of search database, keywords and inclusion criteria used for the literature review.

Search database	Keywords	Inclusion criteria
• Google scholar • IEEEXplore • Science Direct • Scopus • Taylor & Francis online • Emerald Insight	smart home, house interior, home design, Malaysia	Initial screening (title, abstract and full report). English language. Scholarly publication articles and journals between 2010 until 2020. Peer reviewed sources addressed smart home interior in Malaysia.

3.2 Inclusion and exclusion

There are six database that are relevant to the topic area for this research are studied. These databases contain the most comprehensive number of articles for further research to be evaluated and obtained. From these six databases, four keywords have been used in the research which are smart home and Malaysia, house interior and Malaysia, “smart home” and Malaysia and last but not least “smart home”.

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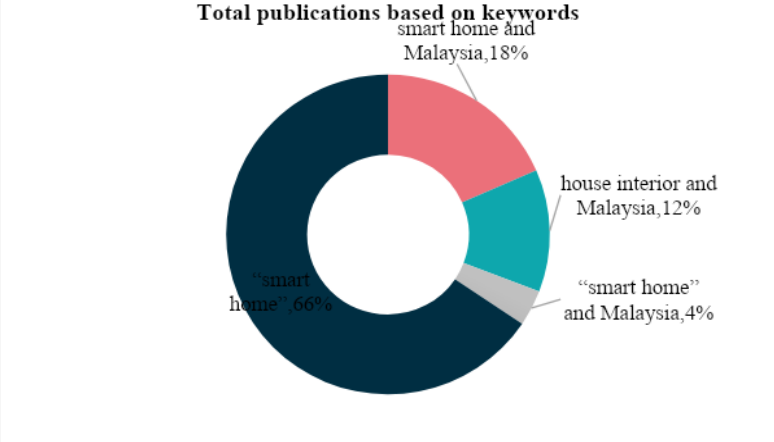

Figure 1: Total percentage of publications based on four keywords

Based on four keywords, the "smart home" keyword is 66 percent, showing the most common keywords used throughout the publications. This keyword has been used by both international and Malaysian publications from 2010 to 2020. The keyword “smart home” and Malaysia with 4 percent show the lowest percentage among the four keywords. This keyword is more applicable to a smart home in Malaysia only.

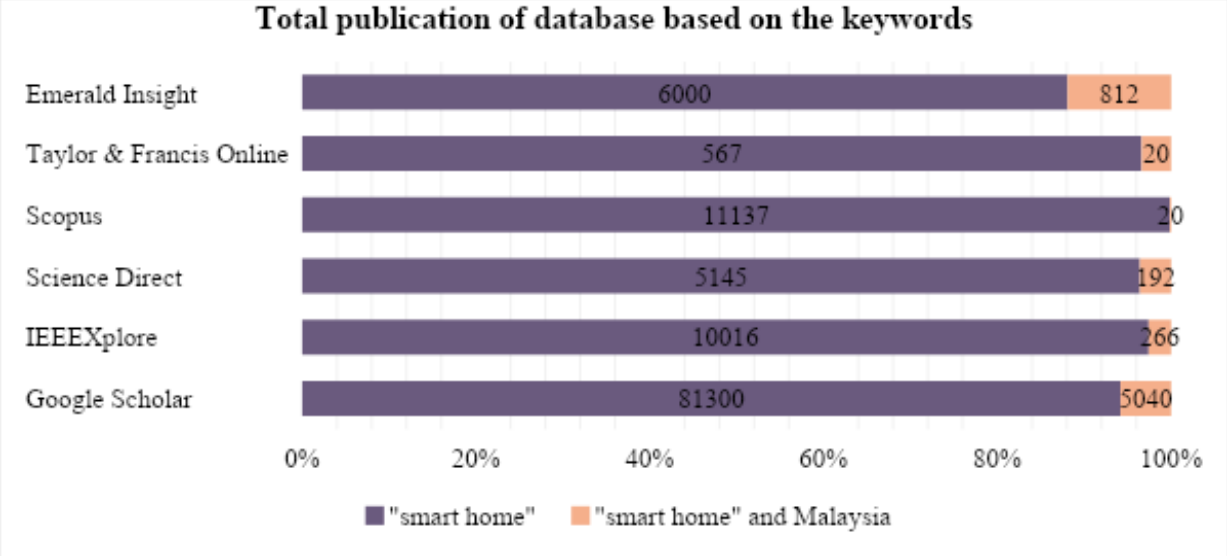

Figure 2: Total percentage of publication from the keywords in the database.

Figure 2 indicates the contrast of the highest total publication based on the keywords "smart home" and both the lowest total publication based on the keywords "smart home" and Malaysia. Most of the keywords "smart house" is released in international publication, while the keywords "smart home" and Malaysia concentrate mainly on Malaysian publishing. The abstracts and all of their chosen papers have been analyzed manually and carefully in order to prevent any prejudice in publishing in order to ensure an acceptable quality of the content. The inclusion of

data evaluation will follow the requirements of a selected paper. These criteria include the terms of the search, limits (title, subject and date), abstract screening, extraction of data and so on. However as can be seen from Figure 2, the cumulative publication focused on these two keywords also has a large void. It reveals that international publication is now researching more of smart home than Malaysian.

3.3 Data extraction

The data is being collected and accordingly specified in columns. The first column label as the author as easy for references. Then, the second column suggested that the article describes meanings and its description of the smart home (Y= Yes, N= No). Next, the third column illustrated the methodology of design used in the papers. The fourth column describing the design factor from the article and journal. Lastly, the findings explaining the article as a whole are either related to the interior of the smart home, or not. The data are then extracted into two groups: first, under Malaysia 's publication, and second, with regard to the smart home interior, from the foreign publication. The table below shows a list of reviews of literature using different methodologies.

3.3.1 Malaysia publication articles and journals

Table 2: List of Malaysia article and journal regarding the smart home interior.

Authors	**Y/ N**	**Methodology**	**Design factor**	**Findings**
Yeon [9]	Y	Interview	Housing development law	The findings show that amendment and improvement to the following statutes and regulations is needed i.e. the Uniform Building By-Laws 1984, Housing Development (Control and Licensing) Act 1966 and its Regulation, the Street, Drainage and Building Act 1974 (Act 133), the Town and Country Planning Act 1976 (Act 176) and States' Planning Control Rules.
Rasyidah et al. [2]	Y	Questionnaire survey	Smart home concept	This research aims to investigate the awareness of potential home buyers specifically among the young millennials on smart home concept; perception on the factors influencing them to buy and key features that they will consider in buying a smart home. Findings showed that the

				knowledge on smart home concept is still low among the target population
Alam et al [1]	Y	Literature review	Collective information about sensors, multimedia devices, communication protocols, and systems	An overview of previous smart home research as well as the associated technologies.
Reaz [10]	Y	Literature review	Artificial intelligence (AI)	This article highlights research projects employing multi-agent system, action prediction, artificial neural network, fuzzy logic and reinforcement learning.
Nisar et al. [8]	Y	Prototype	Wireless Sensor Networks (WSNs)	A system which can prevent wastage of electricity, preserve human energy and simultaneously improve the quality of life of elderly persons
Wei et al. [11]	Y	Questionnaire	Technology acceptance model	The purpose of this study is to make a systematic and empirical study on the factors and model that influencing the intention to adopt smart home in Malaysia. From the statistical analysis, the result verifies that clear interface, consistency, attractiveness, information accuracy, perceived security, and perceived privacy have positive impact on the Malaysia householder's intention to adopt the smart home.
Ramlee et al. [12]	Y	Prototype	Home Automation System (HAS)	This paper presents the overall design of Home Automation System (HAS) with low cost and wireless remote control. The implementation of wireless Bluetooth connection in control board allows the system install in more simple way.
Perumal et al. [13]	Y	Experiment	Interoperability for smart home systems	A new intelligent interoperability framework for smart home systems execution as well as coordinating them in a federated manner.

Mohamed et al. [14]	Y	Literature review	Activities of daily living and ambient-assisted living	An overview of state of art of multi resident activity recognition in smart home environment.

The above tables have evidently indicated that most of the Malaysia publication's article and journal was publishing on roughly regarding the smart home. Specific technology approach towards smart home still have a small number of publications. On the other hand, Malaysia people still have to acknowledge about the smart home nowadays in order to create comfortability, energy-saving, security, and efficiency.

3.3.2 International publication articles and journals

Table 3: List of research studies pertaining to the smart home from the international article.

Authors	**Y/N**	**Methodology**	**Design factor**	**Findings**
Rehman & Gruhn [15]	Y	Literature review	Sicher firewall system	The contribution of this paper emphasis on security issues in smart home system and propose a solution that secure a smart home. The proposed solution has a sicher firewall on software system and on hardware between the net and central hub that minimize security threats and get a warning message against every illegal attempt from outsider.
Wilson et al. [16]	Y	Survey	Smart home technologies (SHTs)	This paper characterizes the perceived benefits and risks of smart home technologies (SHTs) from multiple perspectives.
Fabi et al. [5]	Y	Literature review	Smart Home system	Providing insight on the concept of “Smart Home” considering the adaptive actions performed by occupants to restore their wellbeing.
Hargreaves et al. [17]	Y	Survey	Smart home technologies	This paper reports on new in-depth qualitative data that explore the domestication of a range of smart home technologies in 10 households participating

				in a nine-month field trial. this study has shown that an understanding of domestication must not be limited solely to new technologies. Domestication depends just as much on the properties of SHTs themselves as it does on the wider personal biographies and everyday lives of their users.
Li et al. [18]	Y	Literature review	Smart grid, Internet of Things (IoT)	This paper analyzes the characteristics of smart home, gives the smart home composition and the application of key equipment; and smart home key technologies to illustrate the design of smart home electricity service system and related communication system.
Soliman et al. [7]	Y	Case study	Embedding intelligence into sensors and actuators using Arduino platform, networking smart things using Zigbee technology, Cloud services, JSON	This paper presents an approach to the development of Smart Home applications by integrating Internet of Things (IoT) with Web services and Cloud computing
Karagianni & Geropanta [19]		Case study	Internet of Things (IoT)	This article presents a methodology to transform a traditional home to a smart home. Along these lines, two observations are highlighted: first, that there is an obvious need for new concepts of "enhanced architectural design" that are driven by, and appropriate for, smart homes; and second, that it is fundamental to reconsider the role of user motivation to bridge the gap between the functionalities offered by smart services and user's needs.

Bitterman & Shach-pinsly [20]	Y	Literature review	Architecture and health care, smart home and its technologies , obstacles and the possible implications on our future living	To bridge the knowledge gap between the disciplines of computing, architecture and health care, in order to provide architects, designers and planners with an integrative overview of the smart home, its technologies, objectives, problems and obstacles, including suggestions for overcoming these obstacles and the possible implications on our future living
Komninos et al. [21]	Y	Literature review	Smart grids, smart homes security	In this paper they presented dangers looming under some of the most illustrative scenarios of interaction amongst entities of the smart home/smart grid environments, evaluating their impact on the entire grid.

Results

The above literature findings have clearly identified how smart home interior have been approach nowadays especially from the international country rather than Malaysia. Analysis from the figure 1 show smart home already have a huge number of publications in international rather than Malaysia. Comparison between two keywords based on database also show international and Malaysian publication have a huge gap in the publication journal and article. From the findings of literature review in table 2, Malaysia article and journal mostly approach the smart home interior nowadays. Malaysian publication still has a small number of technology approach towards the smart home interior rather than international. Based on table 3, international publication shows various types of technology have been publish in the article and journal. Comfortability, energy-saving, security, and efficiency were the dominant outcome of smart home interior. Moreover, according to Wei et al. [11], attractiveness, information accuracy, security and also privacy information considers an significant aspect that will affect the decision of Malaysian householders to implement a smart home system.

Conclusion

The results from the systematic reviews enable future researchers to further evaluate and assess on the important role of the smart home interior in Malaysia. Some of the example from the previous international article and journal might be useful to implement for Malaysian housing. Analyzing some of smart home system and technology from the international might be useful use

to implement in Malaysia. It should consider the characteristic of it as Malaysia have different types of weather. If smart home is widely used by our Malaysian people, the cost of smart home could be lower, and it's affordable to buy a majority of people in Malaysia in the future.

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