

Smart Home Users Perception on Sustainable Urban Living and Legal Challenges in Malaysia

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Abstract

Smart homes can improve life by providing comfort, leisure, safety, and healthcare to residents. Nevertheless, the smart home concept depends on the integration on human and non-human intelligence, which raises a host of questions concerning its implication on legal liability. The legal issues in relation to definition of smart home, data protection, privacy, liability and insurance coverage. The aims of this paper is to discuss the perception of smart home users on the sustainable urban living and its challenges. This is a qualitative study and involves a small survey among smart home users in Kuala Lumpur. The findings show that there is no legal specific definition of smart home, there is no specific standard or specification issued by any regulatory bodies to regulate the network or appliances being used in smart homes. Majority of residents agreed that there are threats of privacy to smart home users. And privacy is not guaranteed and majority of residents agreed that their smart home and devices is not covered by insurance policy. Hence, a policy and specific law or at least provisions regarding smart home must be drafted or inserted in the present statute initiated by the Ministry of Urban Wellbeing, Housing, and Local Government of Malaysia.

Keywords: Smart home; Modern housing; Smart home users; Perception.



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1. Introduction

According to Bing *et al.* (2011) smart homes can improve life by providing comfort, leisure, safety, and healthcare to residents (Bing *et al.*, 2011). This is in line with the agenda of the fourth industrial revolution (4.0 IR) which witness the role of information technology system becomes a focal point. Nevertheless, the smart home concept depends on the integration on human and non-human intelligence, which raises a host of questions concerning its implication on law and legal liability. In Malaysia, the plan for future cities involves smart mobility and connectivity. It focusing on public transportation instead of building, more roads and improving strategic ICT infrastructures to ease the process of conducting business. As well as for an easier lifestyle without actual movement on the roads. It would provide new economic opportunities for people living in cities as well as in rural areas. Furthermore, this programme can produce smart people and improve behaviours by taking on the grassroots and younger generation, providing training and events to promote harmony living, and developing job opportunities and reach-out programmes.

The application of a full smart home is still not widespread among home owners in Malaysia. The reason is due to the cost to fix these products in the house and its complicated use due to its advanced technological procedure. Nonetheless, some partial and quasi-smart home products are provided to serve the special needs of home occupants. For instance, the provision of a home security alarm system to prevent burglary and house breaking, and smart home products that can control lighting, temperature, multi-media, security, window, and door operations (Smart Home Concept, 2003).

At present, there is no public housing policy by the Ministry of Urban Wellbeing, Housing, and Local Government of Malaysia (MUWHLG) that requires housing development projects subjected to its jurisdiction to incorporate and apply smart home products and facilities. Neither are there such requirements under the Building Description (Fourth Schedule), Form of Service Charge Statement (Fifth Schedule) and contractual terms in the respective standard formatted sale and purchase agreements – Schedules G, H, I, and J of the Housing Development (Control & Licensing) Regulations 1989. Consequently, smart home products and facilities are not a legal

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requirement under the Housing Development (Control & Licensing) Act 1966 (Act 118). The fixing of smart home products and facilities are up to the wishes of individual home proprietors. They will negotiate and enter into a sale and purchase agreement with smart home product contractors and providers to incorporate the products into their respective houses at their own costs. However, if the housing developer offer and promise smart homes facilities to be equipped in the housing project, hence the legal relationship between the buyer and the developer is based on their sale and purchase agreement. The basic principle of law which are applicable is the Contract Act 1950. Based on the statement above it is vital to get an insight opinion of residents of smart home pertaining to its benefits and challenges.

2. Literature Review

Smart home which is equipped with gadgets and information technology system minimizes the residents' intervention in monitoring and controlling home appliances for their convenience and promotes energy efficiency (Soliman *et al.*, 2013). In general, a smart home has four main systems, namely: (i) Home Appliances, Lighting, and Climate Control System; (ii) Home Entertainment System; (iii) Home Communication System; and (iv) Home Security System (Mantas *et al.*, 2010).

Various technologies are used to provide autonomous assistance and benefits to the residents of smart home environments. Despite the benefits and broad applicability, there are critical privacy challenges arising from this technology (Park *et al.*, 2013). Private and personal information of the residents may be conveyed without consent. In this context of smart home environment, the issue involved is informational privacy, where private data and personally identifiable information directly identify a person, such as the name, gender, and age (Kirmse, 2012).

It is likely that unauthorised intrusion and access to private personal data by a third party or other forms of misuse may occur to mobile devices and ambient networks (Schaefer *et al.*, 2006). Thus, although this technology is designed to make users' lives more convenient, it also implies privacy concerns (Kirmse, 2012).

The idea behind any definition of privacy is to have control over information about oneself and control the access to personal information as well as realise intimacy. However, a person's need of privacy can conflict with the interest of other persons, e.g. healthcare information in a family, and even the person themselves (Kirmse, 2012). The residents' privacy can be invaded without them knowing about it. The main objective of privacy protection in terms of personal data is to ensure that private data remains protected while processing or releasing sensitive information.

Apart from the infringement issue of personal data, the use of smart technologies and equipment in smart homes has some impact on criminal liability and liability under tort (Hildebrandt, 2011). In a smart home, products and services generally work together through a hybrid of network and functions. The 'intelligence' of a smart home is usually imbedded in the computing and network system and it does not require human input. Instead of intentional programming of specific tasks, functions, and actions by the users, the smart technologies and equipment in a smart home create an intelligent environment that is capable of anticipating users' needs and preferences and act to cater for these needs and preferences on its own even before the users become aware of them (Hildebrandt, 2008).

The absence of conscious intention, decision, and action by a specific person therefore creates legal problems, especially in respect of determination of causation, wrongdoer or tortfeasor, proving intention, negligence etc (Vladeck, 2014). It is difficult to determine the initial action that actually caused the harm or damage when the act is a series of actions prompted by the intelligent environment. In cases where causation is crucial, for example, in making insurance claims, failure to determine the proximate cause can jeopardise the claimant's right to compensation.

The attribution of fault is also made difficult by this intelligent environment. When the action is prompted by the intelligent environment, finding a specific user in the house who is responsible for the harm or damage is almost impossible. Therefore, the question of who will bear the legal consequences of an act done by the smart house that caused harm or damage to another person is very difficult to be answered.

In addition, the absence of any conscious thought by the user resulting in the act that caused the harm or damage also causes problems in proving intention (*mens rea*); a fundamental requirement in some criminal action (Asaro, 2011). Since the act is based on how the intelligent environment anticipates users' needs and preferences without the users' intervention, the 'guilty mind' or the modes of culpability is supposed to be assessed.

Moreover, the concept of smart technology and equipment has some bearing on the issue of legal personhood (Mahdzir *et al.*, 2017). A smart home employs devices that can function and think on its own, anticipate human needs, and act to cater for human needs. Therefore, a smart home can act as a person. Although it is hard to imagine a house or household appliances becoming the culprit of a criminal or tortious charge, the notion is not impossible especially when the smart technology and self-management system that were built in their programmes have actually generated a 'person' that can be attributed to a crime or tortious act. When this happens, the issue now is who should be called to account for its actions? Is it the manufacturer of the device, the installer, the developer or the owner of the house? These questions perhaps will be highlighted from the findings of the study among residents of smart home.

3. Research Methodology

This is a qualitative study and it involves a small survey among the residents and home owners of a smart home project in Kuala Lumpur. The discussion below will elaborate their opinion on several issues pertaining to smart homes. It includes their perception (i) on reasons of smart home as a choice; (ii) definition of smart home; (iii) types

of technology appliances/devices available in house; (iv) need of smart home; (v) need to develop more smart houses in Malaysia; (vi) constraints living in a smart home; (vii) user's privacy; (viii) residents' understanding of privacy; (ix) threats of privacy; (x) data control; (xi) legal liability and (xii) insurance coverage.

Table 1.1 shows the profile of residents who participate in the survey. Each of the respondents have a different range of age, which is from 31 until 60 years old at the time of data collection with different backgrounds of profession such as project manager, consultant, pilot, engineer, plantation employee as well as a retiree. The smart home residence encompassed of six types of house including townhouses (Schumann 1), super link homes (Schumann 2), park link terraces (Schubert), garden terraces (Mozart), garden twin villas (Beethoven), and eco-dominiums (Verdi). Each of the respondents stayed at different types of house with the duration of a year and above from the date when the questionnaires were distributed.

Table-1.1. Residents' profile

No.	Respondent	Gender	Age	Occupation	Type of House	Living Period	Duration 10/1/2017
1	R20A	Male	38	Project Manager	Park home	June 2016	7 months
2	R20B	Male	42	Consultant	Super link	October 2016	3 months
3	R20C	Male	31	Pilot	3-storey end lot link	2014	3 years
4	R20D	Male	60	Retired	Semi-detached	-	
5	R20E	Male	40	Engineer	Terrace	January 2016	1 year
6	R20F	Male	49+	Plantation Employee	Link	February 2016	11 months

4. Findings

The contract between the housing developer and the residents was signed on 19th September 2011. However, a majority of the residents moved in after three years and more after signing the agreement. As can be seen in Table 1.2, four residents started living in Smart Home in 2016, one resident in 2014, and one resident did not give any response to the question. The data on the move into the new home is reflected in Table 1.2.

Table-1.2. Duration of stay

Respondent	Statements
R20A	June 2016
R20B	October 2016
R20C	2014
R20D	-
R20E	January 2016
R20F	February 2016

According to the residents, they chose to live in a smart home due to privacy (5), tranquillity of the neighbourhood area (4), smart technology devices (4), modern lifestyle (4), convenience (2), and energy efficiency (1). This is elaborated in Table 1.3.

Table-1.3. Reasons of smart home as choice

R	Statements							
	Tranquillity	Tech	Energy	Convenience	Privacy	Support	Incentive	Lifestyle
R20A		√						√
R20B	√	√			√			
R20C	√	√		√	√			√
R20D	√				√			√
R20E		√			√			√
R20F	√		√	√	√			

In relation to the respondents' understanding on the definition of a smart home, it is found that different respondents have their own interpretation as highlighted in Table 1.4. A smart home, according to the house owners, must have elements of an information technology programme, controlling devices, security, and application of a green concept.

Table-1.4. Definition of smart home

Respondent	Statements
R20A	A home that is able to be connected via devices by apps or command. It is equipped with a two-way communication, e.g. able to adjust the environment to suit our daily life trend
R20B	Ability to control operations from mobile devices
R20C	Technology should make our life easier
R20D	A system that facilitates the control of lighting/air conditioning and security
R20E	A house that can be controlled remotely
R20F	A house with state-of-the-art technology for IT, security, and green concept

Furthermore, in terms of the types of technology appliances/devices available in the house, it is stated as in Table 1.5 below, where a majority of the respondents agreed that security and alarm system, closed-circuit television (CCTV) system, and sensor are the basic devices provided by the developer. Only one respondent stated that besides the basic devices as mentioned above, his house has other devices such as a smart thermostat to control temperature, lighting, curtain, water sprinkler, sound system, and automatic alarm. Another respondent said that other than the basic devices, his house has been provided with wireless switches and appliances.

Table-1.5. Types of technology appliances/devices available in house

Respondent	Statements
R20A	Security and alarm system, CCTV and sensor Smart thermostat to control temperature, lighting, curtain, water sprinkler, sound control, and automatic alarm system
R20B	Security and alarm system, CCTV, and sensor
R20C	security and alarm system, CCTV, and sensor Wireless switches and appliances
R20D	Security and alarm system, CCTV, and sensor
R20E	Security and alarm system, CCTV, and sensor
R20F	Security and alarm system, CCTV, and sensor

A majority of the respondents agreed that smart homes are needed in Malaysia because they provide more perfection to people's daily life and better security and energy conservation as illustrated in Table 1.6.

Table-1.6. Need of smart home

Respondent	Statements
R20A	Yes. It's a big data generation. Machine talk definitely will make more perfection to our daily living life
R20B	Yes Ease of control
R20C	Yes
R20D	No Ask the developer/concerned authority
R20E	Yes For convenient of the residence
R20F	Yes Better security & energy conservation

They also agreed that more smart home projects should be developed in Malaysia (refer Table 1.7).

Table-1.7. Need to develop more smart houses

Respondent	Statements
R20A	Yes. It is the IT generation. We cannot escape but to go through this process of IT revolution
R20B	Yes Ease of control
R20C	Yes
R20D	Yes Trouble-free monitoring of electricity use and security
R20E	Yes For the convenience of the residents
R20F	Yes Better quality life

Table 1.8 illustrates the constraints living in a smart home. Based on the respondents' experience, there are a few constraints when living in the smart home, such as bad Wi-Fi connection, lack of knowledge in using the house system, bad quality devices, high maintenance cost, difficulty in obtaining repair service, and complexity of the system.

Table-1.8. Constraints/problems living in a smart home concept

Respondent	Statements
R20A	Bad Wi-Fi connection Lack of knowledge relating to the usage of the house system Non-quality of smart home devices High cost for maintenance and devices Complexity of the house system
D R20B	Difficulty in getting repair services in the situation of malfunctions of devices at home Bad Wi-Fi connection Lack of knowledge relating to the usage of the house system Non-quality of smart home devices High cost for maintenance and devices Complexity of the house system
R20C	Difficulty in getting repair services in the situation of malfunctions of devices at home Bad Wi-Fi connection Lack of knowledge relating to the usage of the house system Non-quality of smart home devices High cost for maintenance and devices Complexity of the house system Developer not familiar with the system. Third party communication takes a long time; too many departments to fix one problem
R20D	Difficulty in getting repair services in the situation of malfunctions of devices at home Bad Wi-Fi connection Lack of knowledge relating to the usage of the house system Non-quality of smart home devices Complexity of the house system
R20E	Lack of knowledge relating to the usage of the house system
R20F	Difficulty in getting repair services in the situation of malfunctions of devices at home Bad Wi-Fi connection Non-quality of smart home devices

Based on the survey findings among the residents, there are similarities of understanding or perception of the residents in terms of the definition or interpretation of a smart home. The characteristics of a smart home are diverse according to individual opinions. However, the basic elements of a smart home are significant to be included in formulating the policy and law of smart homes. This is to define the smart home and avoid conflicts of understanding between the buyer, developer, and regulator. Even though there are constraints in living at smart home, but smart home users still positively accept the need of new development of smart home housing in achieving sustainable urban living.

Other issue which relevant in relation to smart home is to get the opinion of residents' perception on privacy and data protection. In relation to privacy issues it is comprised of (a) guarantee of privacy; (b) residents' understanding of privacy; (c) threats of privacy; and (d) data control in the context of smart homes as illustrated in Table 1.9. Six of the respondents were able to answer all questions except question numbers 2 and 3, which were left empty by the respondents.

Table-1.9. User's privacy

No.	Item	R20A	R20B	R20C	R20D	R20E	R20F	Total
1	Guarantee of privacy	√	√	√	√	√	√	6
2	Understanding of privacy	√	√	-	√	√	√	5
3	Threats	√	√	√	√	√	-	5
4	Data control	√	√	√	√	√	√	6

Concerning the issue of privacy, smart home users were asked whether their privacy is guaranteed by living in a smart home (refer Table 1.10). Four of the respondents believed that privacy in a smart home is guaranteed. Meanwhile, R20C and R20D responded that the privacy is not guaranteed due to the reason that, "IP fed is given

via a web address that can be accessed by anyone” as mentioned by R20C, while R20D is unsure regarding the reason of no privacy guarantee in smart homes.

Table-1.10. Guarantee of privacy

No.	Answer	R20A	R20B	R20C	R20D	R20E	R20F
1	Yes	√	√			√	√
2	No			√	√		

Next issue is regarding their understanding on the meaning of privacy. All of the smart home users stated that the meaning of privacy is “no interference from outsiders”, except R20C who did not answer the question.

Concerning the issue of threats of privacy, to the answers of the smart home users vary, in which a majority of them agreed that, “transferring of personal data by the developer without consent” may cause a threat to their privacy. Meanwhile, three of the respondents, R20A, R20B, and R20C, answered that, “receiving calls and emails from unknown persons” may cause a threat of privacy. Meanwhile, the rest of the answers given pertaining to the threats of privacy were: “your whereabouts are known to people whether you are at home or outside”; “frequently receive advertisements for commercial purposes”; “hacking activity into your system through the Internet”; and “personal data information is exposed to the other party” with a total score of 2 for each answer. The threats of privacy survey results are displayed in Table 1.11.

Table-1.11. Threats of privacy

No.	Item	R20A	R20B	R20C	R20D	R20E	R20F	Total
1	Receiving calls and emails from unknown persons	√	√	√	-	-	-	3
2	Transferring of personal data without consent	√	√	√	√	√	-	5
3	Your whereabouts are known	-	√	-	√	-	-	2
4	Frequently receive advertisements	-	√	√	-	-	-	2
5	Hacking activity	-	√	-	√	-	-	2
6	Personal data information is exposed	-	-	√	√	-	-	2

Lastly, the respondents were asked on whether personal data can be controlled and protected in a smart home as shown in Table 1.12. Five of the respondents agreed that data can be controlled and protected by several methods. Each of them proposed a suggestion: R20A: “by having a proper firewall”; R20C: “enforcement of a data privacy act”; R20E: “good cyber security and password activation”; and R20F: “password protected”. Meanwhile, R20D did not propose any method as he is not an expert. Only R20B disagreed that personal data in smart homes can be controlled and protected.

Table-1.12. Data control

No.	Answer	R20A	R20B	R20C	R20D	R20E	R20F
1	Yes	√		√	√	√	√
2	No		√				

The next issue is residents’ perception on legal liability and risk. Table 1.13 shows the answers for the questions asked on the issues of legal liability. The questions include (i) whether the residents have been engaged in any case/claim/ lawsuit involving the use of smart homes/ smart home technology; and (ii) whether they were provided with insurance to insure the safety of the house and the devices. All of respondents have answered the question.

Table-1.13. Issues on legal liability

No.	Item	R20A	R20B	R20C	R20D	R20E	R20F	Total
1	Lawsuit	√	√	√	√	√	√	6
2	Insurance	√	√	√	√	√	√	6

The first question concerned their involvement in any case, claim, or lawsuit relating to the use of smart homes and smart home technology. None of the respondents were involved in any lawsuit; however, R20A responded that, although there is currently no such case, but action will be taken due to the poor quality of products. R20A informed that, “not at the moment, will do it in near future due to the poor products by the developer”. On the other hand, R20C had lodged a report concerning the slow connection of the Internet. R20C stated that, “the smart housing project infrastructure could not support 500 mbps connection”.

Lastly, pertaining to the insurance coverage for the smart home and devices, four of the respondents answered that there is no insurance for the smart home and smart devices, while the remaining two, R20B and R20F, answered yes and stated that the safety of the house and the devices were insured as shown in Table 1.14.

Table-1.14. Insurance coverage

No.	Answer	R20A	R20B	R20C	R20D	R20E	R20F
1	Yes		√				√
2	No	√		√	√	√	

5. Discussion and Recommendation

From the findings there are several issues to be contemplated. Firstly, variation of definition of smart home. Since there is no specific statute in Malaysia provides the definition of smart home or stipulate the basic elements of smart home, therefore it opens to definition disparity by the developers, users and regulators. Secondly, majority of the residents agreed that security and alarm system, closed-circuit television (CCTV), and sensor are the basic elements that must have in a smart home. Are these facilities sufficient to recognize it as smart home? Therefore, there is a need to have a law governing smart home in Malaysia to define and stipulate basic facilities of smart home. This can avoid unethical behaviour among smart home developers whom can easily claim that their housing project are smart housing, but in reality it is not.

Further, on the problem of attribution of criminal or tortious liability if a house becomes automated – who will be liable (the house owner or the vendor) should glitches occur to the network or appliances and cause harm to other people. Furthermore, it is argued that there is no specific standard or specification issued by any regulatory bodies to regulate the network or appliances being used in smart homes. The absence of a specific standard does not only affect the quality of the network and appliances being used, it also casts a doubt as to the integrity of data obtained using the network and appliances. For example, the installation of CCTV and home safety monitoring systems.

The findings also disclose problems and constraint faced by residents of smart home. There are a few constraints when living in the smart home, such as bad Wi-Fi connection, lack of knowledge in using the house system, bad quality devices, high maintenance cost, difficulty in obtaining repair service, and complexity of the system. In the area of smart home project, a basic facilities needed is not only water and electrical supply but internet connection must be at all time in an excellent condition. Internet access is a basic needs and it should be in a compulsory list to be provided by the developer before smart home project to be issued the completion certificate and occupied by people.

The issue of threats of privacy to residents should be tackled accordingly, by the developer and also the regulators (Basaruddin *et al.*, 2017). In terms of enforcement of law by regulators, it creates difficulties because it will involve several ministries, departments and local authority. Therefore, a specific law or at least provisions regarding smart home must be drafted or inserted in the present statute initiated by the MUWHLG. This is in line with the findings of Hargreaves and others, where policy-makers have a potential role to generate standards, benchmarks and guidelines. This is to ensure smart home technologies are developed, tested and evaluated in ways that minimize the potential for energy intensification (Hargreaves *et al.*, 2018).

6. Conclusion

Although smart home project has some legal issues to be resolve (Yeon *et al.*, 2018), nevertheless the needs for this efforts to be enhanced by the government of Malaysia is positively accepted by the Malaysian people. There is a need in the era of information technology revolution to develop more sustainable urban living supported by IT intelligent system, comfort, home safety-compliant and green environment friendly to every house in Malaysia. If smart home becomes a common use by our Malaysian people, perhaps the cost of smart home becomes cheaper, and it is affordable to buy by majority of people in Malaysia in the future.

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