
Exploring Smart Home Device Use by Airbnb Hosts

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Abstract

An increasing number of Airbnb hosts are using smart home devices to manage their properties; as a result, Airbnb guests are expressing concerns about their privacy. To reconcile the tensions between hosts and guests, we interviewed 10 Airbnb hosts to understand what smart home devices they use, for what purposes, their concerns, and their unmet needs regarding smart home device usage. Overall, hosts used smart home devices to give remote access to their home to guests and safeguard their investment properties against misuse. They were less concerned about guest privacy and felt that smart home devices provided unique value to guests and, thus, a competitive advantage over other Airbnb properties.

Author Keywords

Airbnb; Sharing Economy; Smart home device; Internet of things; Security and privacy;

CSS Concepts

• **Human-centered computing~Human computer interaction (HCI); Human-centered computing~Empirical studies in HCI**

Introduction

While Airbnb is only 12 years old, it already has more than 7 million listings worldwide, covering more than 100 thousand cities in 191 countries [20]. Airbnb hosts offer their properties to strangers (i.e., “guests”) for payment, which creates an interesting research problem around privacy and trust [8]. For instance, recent news has surfaced concerns from guests about privacy violations involving cameras and other surveillance devices found hidden in the home [21]. Airbnb hosts are increasingly using smart home devices to manage their properties to the point that some manufacturers are even developing products just for Airbnb hosts [22]. Airbnb has also developed policies specific to the use of smart home devices [23], such as requiring hosts to only use security cameras outdoors and declaring the same in their listing. Yet, it is also important to understand the benefits and drawbacks of smart home device use on Airbnb properties. Therefore, we did this research from the perspective of Airbnb hosts by asking the following research questions:

RQ1: *What smart home devices are Airbnb hosts currently using and for what purpose?*

RQ2: *What are the concerns and unmet needs Airbnb hosts have regarding using smart home devices?*

We conducted 10 interviews with Airbnb hosts to answer these research questions. By understanding the perspectives of the Airbnb hosts, we provide a better understanding of the status quo of smart home device use in Airbnb and move towards reconciling the privacy tensions between Airbnb hosts and guests.

Related work

We provide a brief overview of relevant literature on the Airbnb sharing economy and smart home research.

Airbnb and the Sharing Economy

Airbnb is the most popular marketplace for sharing home-space between two ordinary people: hosts and guests. This model is known as the sharing economy or collaborative peer-to-peer consumption [8]. According to Botsman and Rogers [4], to succeed in a collaborative economy, trust between strangers is essential. As hosts and guests are normally strangers, this creates interesting problems related to managing trust [4]. Moreover, though the main purpose of Airbnb is to provide accommodations, Ert et al. [6] explain how Airbnb hosts are also expected to provide a unique experience for their guests. Many guests also choose Airbnb over hotels to know about local traditions and specialties better [8]. Edward et al. [12] show that Airbnb facilitates not only provide monetary advantages for hosts but also serendipitous social exchanges between people. As such, attributes of the property and services provided by hosts are important factors for meeting guests’ expectations.

Smart Home Research Beyond the Home

From previous research on smart home device usage [1,2,11], we understand how smart devices are used and shared in close trusted circles, such as within families or among roommates within one’s home. For domestic smart home use, access control decisions are complex [14] and vary according to the level of trust [7,13]. Access control decisions also varies by relationships (e.g. guests [10], roommates [13], and children [3,17]) and other factors like time of the day, scenarios, location of the device [7], and usefulness of

	Age	Gender	Device Types
P1	50+	F	2
P2	40	M	5
P3	39	M	7
P4	64	F	3
P5	42	F	3
P6	23-39	M	5
P7	37	M	12
P8	36	M	5
P9	45+	M	5
P10	30	M	4

Table 1: Profile of Participants

Smart Home Devices	# of Owners*
Smart Lock	10
Smart Thermostat	8
Smart Camera	6
Smart Lights	5
Alexa	3
Wi-Fi Hub	2
Fire-CO Alarm	2

*Devices with less than 2 owners not shown due to space constraints

Table 2: Device Ownership

the device [18]. Overall, He et al. [9] found that most of these devices are designed for personal use, where granular control to share the access with others is lacking. Mazurek et al. [15] also found that most of the time the user tries to achieve more nuanced access control by using makeshift methods. As a result, to give someone else access control to the device one would have to either share the device entirely or not at all. As smart home devices are made for the consumption of multiple users, many researchers have found that they clearly do not address the need of all stakeholders, which can contribute to privacy and security concern for users [5,18,19].

The abovementioned research work focuses on a scenario where smart home devices are being used inside one's home and between trusted individuals. Yet, when extending this research to study Airbnb hosts and guests, we also need to understand how it plays out outside of this trusted circle. For instance, Yao et al. [18] found that some people choose not to rent AirBNB properties because they distrusted that hosts would not install hidden video cameras. Our research is unique in the sense that we examine smart home usage and access control within untrusted relationships in the context of Airbnb from the perspective of hosts. By doing this, we identify the unmet needs of Airbnb hosts regarding their smart home device use, which can inform implications for designing to meet these needs.

Methods

We conducted 10 semi-structured interviews with Airbnb hosts, recruited via social media, who used two or more smart home devices on their properties. Participants owned different kind of properties varying from single apartments to multi-storied "Airbnb-Hotel".

Their locations varied from suburban areas to large urban cities in the US. **Table 1** summarizes the demographic information of our participants, and **Table 2** shows smart home devices owned across our participant sample. The time duration for the interviews varied from 15 to 40 minutes. Interviews were transcribed and qualitatively coded for themes related to 1) motivations or reason for use, and 2) concerns and 3) unmet needs of Airbnb hosts. Interview questions are included as supplementary material. **Tables 3-5** summarize our final codebooks and counts for answering our high-level research questions.

Results

As shown in **Table 1**, our participants were mostly male (N=7) from 6 different states of the U.S and between the ages of 23 and 64. They reported having at least 2 different types of smart home devices installed on their properties. **Table 2** shows the frequency of each smart home device among our participants. Approximately 15 different devices were used by our participants, with smart locks, smart thermostats, and smart cameras being the most popular ones. In some cases, participants owned multiples of the same device but were only counted once in our analysis.

Motivations for Using Smart Home Devices

Below, we summarize the main reasons Airbnb hosts used smart home devices (RQ1).

Physical Security: All participants (N=10) wanted to ensure the physical security of their property by using some combination of smart home devices. For this, they mostly used smart cameras (N=7), while half of them (N=5) used smart locks. Two of our participants

Motivations	Devices (# Hosts)
Physical Security (N=10, 100%)	Camera (7), Lock (5), Fire-CO detector (2)
Monitoring (N=10, 100%)	Camera (8), Lock (5), Thermostat (4)
Remotely Controlling Property (N=9, 90%)	Lock (9), Thermostat (4), Light (3)
Convenience for guests (N=7, 70%)	Alexa (4), Lock (3), Light (3)
Monetary Benefit (N=6, 60%)	Thermostat (5), Light (3)

Table 3: Motivations

used smart fire-CO detectors to get notifications of fire, smoke, or CO build-up instantly so that they could take swift and appropriate action. P1 shared her reason for using a smart lock with a built-in camera, *"It's a good experience to know that because of the videos on entry and exit I don't feel insecure about somebody potentially ransacking my place."* In all cases, participants noted that the cameras were mounted outside the property to see people coming and going, rather than what was happening inside.

Monitoring: All participants (N=10) used different smart devices to keep an eye on their Airbnb property and checking on guests' activities. In most cases, monitoring was due to a lack of trust between the host and the guests. For instance, eight hosts used smart cameras to monitor what their guests were doing. P9 explained, *"If someone says, you know, they're booking the house for themselves. But then.. if I see like, 20 people coming in, I can tell them, they're not being truthful."* Moreover, hosts tracked smart lock usage to know which guest was accessing that area of the house, noise sensing to avoid sound pollution, Z-Wave hub to monitor internet performance, and Roku to ensure guests were not watching inappropriate things in smart TV, etc. In all cases, hosts were worried about guests doing something inappropriate, rather than causing physical harm to the property.

Remote Control: Nine hosts leveraged smart home devices to remotely control access to their property because they were in a different location. The smart lock was the most popular (90% of hosts) device among our participants for this use case. While sharing her experience with remotely controlling her property through the smart lock, P4 said, *"The Smart Lock is*

always great because I didn't have to go there with a key to physically let people in."

Hosts also used thermostats to remotely control the temperature of their house. P1 explained how she uses the smart thermostat, *"I do allow them to adjust the temperature (but) If I find somebody is just being unreasonable, I will lock them out and I only do it remotely."* Only one participant did not want to remotely control his property as he rented out space in his own home and was almost always on-site.

Convenience for Guests: Many (70%) of our participants explained that they used smart home devices as an added value for guests. Four hosts provided Amazon Alexas to let guests control lights, thermostat, ask questions, find local restaurants, etc. P4 said, *"Alexa helps my guests find places to eat, things to do, if they have questions, they can use it for entertainment for their kids."* Hosts also explained that smart lock provided guests the convenience to check-in without needing to collect (or return) physical keys or meeting with the hosts. While talking about why he uses the smart lock, P3 said, *"It also allows the guests to easily get in contact with me. They can ring the doorbell (and) it'll ring on my phone and then they can talk (about)... the issue with the smart lock. And I can kind of walk them through."* Smart lights get turned on automatically, which hosts felt were helpful to guests who were accessing the property for the first time. Overall, hosts wanted to provide added convenience, entertainment, and a way for guests to contact them if they needed assistance.

Monetary Benefit: Devices like the smart thermostat and smart lights helped the hosts monitor the energy usage of their property and manage costs. P7 who

Concerns	Devices (# Hosts)
Mechanical problems (N=5, 50%)	Lock (3), All (1), Wi-Fi (1), Thermostat (1)
Personalized (N=3, 30%)	Alexa (3)
Unreliability (N=2, 20%)	All (2)

Table 4: Concerns

Unmet Needs	Device Count
Device not custom made for Airbnb (N=4, 40%)	Alexa (4)
Ability to sync with Airbnb Account (N=2, 20%)	Lock (2)
Information Privacy (N=1, 10%)	All Devices (1)

manages 19 properties, said, “When they (guests) leave, that’s when it shuts off and (when) the cleaning lady leaves (it) shuts off again. And I tell you, we saved us so much money because, you know, we used to have these things running all day every day.” In general, since renting out their property was a monetary investment, they wanted to be smart about conserving energy to keep costs as low as possible.

Concerns regarding Smart Home Device
We describe hosts’ concerns and unmet needs (RQ2).

Mechanical Problems: Three of our participants faced various mechanical problems with their smart locks. P6 said about his door lock, “the lock can get stuck. If someone tries entering and they release the lower locks. It doesn’t have enough pressure to unlock it. So, the guest has to pull the door back so it latches and takes the pressure off the deadbolt so it can properly unlock.” This often led to having to troubleshoot these devices from a remote location. The need for physical troubleshooting was problematic as these hosts managed their property remotely. According to P3, “when I’m home..., it’s easy, you know, I can reset something, I can unplug something, it’s very easy to deal with. But if it was in my Airbnb property, it would be kind of a problem. You know, you really have to drive there.” So, while the devices provided remote capabilities and convenience, these benefits quickly went away when the devices malfunctioned.

Personalization: Three hosts said that Alexa and other voice assistants were way too personalized to be used inside Airbnb. When asked why she did not use Alexa, P1 explained, “Because I’m concerned about somebody setting up an account and getting involved

with anybody’s personal information that they may have messed up.” So, while some hosts wanted to provide this value to guests, they had privacy concerns. **Unreliability:** In general, Airbnb hosts were often skeptical that smart home devices would work as intended, which was why they decided not to use certain devices in the home. For example, unstable Wi-Fi connection in smart home devices has made them unreliable to two of our participants. They said they could not rely on sensors in various smart home devices, doorbell calling feature, Alexa, etc. to do their job well every time. When asked about his smart things hub use, P3 explained, “I’ve been using it (for) like three years. But what I find is it’s not always very reliable. So, I feel that the technology is still kind of new... you know, sensors disappear, or you know, something wouldn’t respond.” One hosts was concerned about the lack of physical security of her devices—that guests would steal or otherwise break them.

Unmet Needs of Airbnb Hosts

We identified several unmet needs that Airbnb hosts said they desired in various smart home devices.

Customized for Airbnb: Airbnb hosts wanted special access control settings that would allow them to share the capability of smart assistance and entertainment devices (e.g., Alexa and Roku) with their guests without compromising their own privacy and/or security. For example, P6 wanted to have a Customized voice assistant at his property. He explained, “(I want it) so people could ask what time check out was or something (like that) and program the answers (in it).” P7 even made a custom touchpad for his properties by himself. He said, “The tablet was really the thing that really didn’t work for me. So, I had to like do some

coding ...to make it work." In general, they wanted special applications and customizations that accounted for their unique situation of using smart home devices within Airbnb properties.

Interoperability with Airbnb Account: Two hosts wanted smart locks to be able to synchronize with their Airbnb account. For instance, pin generation and distribution could be automatic, rather than manual.

Information Privacy: While we did not explicitly ask any questions related to the privacy of guests, hosts also did not bring this up as one of their concerns. Only one host, P3, was specifically concerned about his own privacy. When asked what changes he wanted in his smart home devices when sharing access with guests, he said *"It would have to be very easily in control of information that those devices can access. And that they have to be, you know, subdivided. So that those devices would not be able to access any information or personal information."*

Discussion

Overall, Airbnb hosts used smart home devices to protect their investment from physical harm or inappropriate use by guests, while providing value-added services to the guest via these devices. Previous research shows, guests (secondary users) have privacy concerns over such smart device use [18]. This uncovers an interesting dynamic and tension between hosts wanting to protect themselves from the same people they wanted to provide services to. Our study is one of the first to uncover this tension and examine

how Airbnb hosts used different smart home configurations to find solutions to solve this problem.

To alleviate these tensions, we offer several design recommendations. First, Smart home devices should be designed in a privacy-preserving way for guests. For example, noise detecting technologies should detect only the decibel levels, rather than record actual conversations. Researchers [16] suggested that Smart home device should be easy to use and convenient. In addition to that suggestion, we suggest policies and laws should be standardized and easily configurable to regulate the use of surveillance devices on Airbnb properties (e.g.,[19]). Our recommendations are based on our participant's concern about their own interests than the privacy of their guests, and in many cases, they were not tech-savvy enough to take un-guided steps to preserve guests' privacy. Second, smart home access control mechanisms need to be redesigned to account for the special use case of Airbnb hosts and guests. Special user roles or profiles for Airbnb guests could be implemented to provide appropriate levels of access, while also protecting the guest from privacy violations by hosts.

Conclusion

We conducted a small, exploratory interview study with Airbnb hosts to understand what smart home devices they used, for what purpose, their concerns, and unmet needs. Future work should further examine the perspectives of both Airbnb hosts and guests and work to resolve tensions between the two stakeholders.

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