The Future of Smart Home Technology in Private Accommodation in Dubrovnik

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The Future of Smart Home Technology in Private Accommodation in Dubrovnik

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ABSTRACT

Smart home technology is a new trend worldwide and its integration is more and more represented in many households. The functions of smart home technology are numerous and they benefit the household owner in terms of living but also when renting the private property. The whole system is controlled and monitored through smartphone, tablet or some other device using internet connection. This research paper investigated the future of smart home technology in private accommodation in Dubrovnik. A questionnaire was distributed to 50 private accommodation owners in Dubrovnik and its area. The questionnaire measured whether they are familiar with the 'smart home technology' and how likely it is that they would integrate the system or some components into their private property. Results slightly confirmed and supported the hypothesis (''The owners of private accommodation in Dubrovnik are familiar with the 'smart home technology', but due to the high costs of implementing this system and because of the situation of Covid-19 they will not be willing to buy or spend much money on it''.). In the end, it is concluded that City of Dubrovnik or tourist board should create panels and programs in order to educate people more about this.

The Future of Smart Home Technology in Private Accommodation in Dubrovnik

Due to the fact that technology today plays a very important role in our daily lives and jobs we do, it is not difficult to assume that technology will become the essential and inevitable 'tool' to live. Since people use technology in large numbers and lot of segments of their lives, it affects and makes significant changes in the business operations. We can say that the usage of technology in businesses and tourism industry is a very important strategic tool to gain competitive advantages over competition.

With the increasing development of technology, people are being given somehow an 'easier' life. Today life has become hectic, people are busy with work and do not have time to do household chores. Speaking about owners of private accommodation, it is a fact that they need something that will allow them to be in constant 'contact' with the house and to be able to control it from wherever they want if it is necessary.

Home automation is basically an automated building which is called a smart home or smart house. A home automation system is based on controlling and monitoring home attributes such as lighting, heating, cooling, entertainment systems, and appliances. It also includes home security such as access control, alarm systems and sensors which will inform the owner of private accommodation in case something happens. Home automation basically allows homeowners to control their houses through smartphone or a tablet through an Internet connection. Smart home technology provides homeowners with energy efficiency, comfort, better security and convenience. Furthermore, Smart Home is accessible from anywhere in the world at any time of the day. Nowadays, smart homes are primarily about sustainability, 'living greener' and providing

security to homeowners. Because of that, the implication could be of a great help to the owners of private accommodation. The implementation of 'smart technology' into a house can not only meet, but can exceed guest satisfaction and experience which will probably boost their overall stay and travel experience.

It is a relevant topic today and it will definitely be in the future because according to the study by the Consumer Technology Association (CTA), the majority (69%) of U.S. households now own at least one smart home device. That translates to 83 million households and out of those, 18% or 22 million homes, own more than one smart home product. Furthermore, according to the Digital Market Outlook, the number of Smart Homes in the market worldwide is expected to be 482,8 million in 2025.

The purpose of this project is to find out how much the owners of private accommodation in Dubrovnik are familiar with the term "smart houses". Furthermore, this research will investigate how likely it is that they will implement this system (or some components) into their private accommodation. The final question of this research project is what is the actual future of smart houses in Dubrovnik.

The hypothesis of this research is: The owners of private accommodation in Dubrovnik are familiar with ''smart home technology'', but due to the high costs of implementing this system and because of the situation with the pandemic of Covid-19, they will not be willing to buy or spend much money on it.

In order to gather this information, this research will be using the quantitative method, in this case a survey which will be distributed electronically through e-mail. Participants of the survey will be owners of private accommodation in Dubrovnik.

The Beginnings of Smart Houses

Although it may seem that this concept of Smart Houses is just based on some artificial intelligence or robotics, it is not true. In the past people would do their household chores (washing the clothes, sewing, drying the clothes...) with the 'bare' hands or with the help of the nature (wind, water, sun, soil. The smart home concept started with the invention of remote controls, unveiled by Nikola Tesla in 1898 (Sinha G. Gaurav, 2018). Furthermore, early home automation also began with labor-saving machines which helped houseowners a lot. Self-contained electric or gas-powered home appliances became viable in the 1900s with the introduction of electric power distribution (McGraw-Hill, 1999). This led to the introduction of vacuum cleaner (1901), washing machines (1904), water heaters (1889), refrigerators, clothes dryers, sewing machines, dishwashers, kettles, toasters, coffee/tea makers, cookers etc. To be precise, this has nothing to do with 'smart' appliances, but the appearance of these things was the introduction of 'home automation' for the people of 20th century. The actual history of smart home technology goes back to almost 40 years. The term ''smart home'' was originally coined by the American Association of House Builders in 1984 (S. Solaimani, W. Keijzer-Broers, and H. Bouwman, 2015.) More recently, the evolution was brought by Internet of Things (IoT) making the innovations in sensors and microelectronic devices.

Applications and Technologies

Smart home technologies include sensors, interfaces, numerous appliances and devices which are connected together in order to enable the automation and remote control of the property (Cook, 2012). For example, there are systems of air condition, ventilation and heating. To be able to

control them it is possible to have a remote control which monitors and controls them all through internet friendly interface. Lighting control system is also connected through different lighting control system inputs and outputs with one or more central computing devices. Furthermore, there is so-called occupancy-aware control system which allows homeowner to see the occupancy of the home using smart meters and environmental sensors (CO_2). They can be integrated in the system for energy efficiency. Appliance control and integration is implemented with the smart grid and meter in order, for instance, to take advantage of solar panel output to run washing machines. Furthermore, there are home robots and security system which can provide remote surveillance of cameras over the Internet or it can basically allow homeowner to access control and central locking of all doors and windows in cases of burglary or similar. Smart houses also provide smoke and leak detection with CO detectors, indoor positioning systems (IPS). It is of a great help to the elderly or disabled persons because it provides home automation for them. It also has 'Pet and Baby Care' which tracks the pets and babies' movements. It can also tell the difference between burglars and pets. So-called Air Quality Egg is used in order to monitor the air quality and pollution level which is present in the building. There is also 'Smart Kitchen' and 'Connected Cooking' which provides help in the kitchen by connecting to the voice assistant or apps. Last but not least are voice control devices like Amazon Alexa, Google Home or similar which are used to control home appliances and systems. The variety and diversity of available Smart Home Technologies means the smart home has many possible configurations, in other words 'smartness of the house' (Aldrich, 2003). Furthermore, smart home technology is not just integrated to turn devices and appliances on and off, moreover it is able to monitor and control internal environment of the property and the activities which occur inside whilst the house is occupied (Ricquebourg, Menga, Marhic, Durand, 2007).

Smart Home Advantages

According to Robles and Kim (2010), the idea of smart homes is primarily to make life more convenient, comfortable and easier in the end. In most cases it can provide the peace of mind, especially in terms of private accommodation because then owners do not have to physically go to the apartment or a house to check if everything is ok, they can just open their smartphone or tablet and see there. If anything happens, they will get an e-mail, notification or similar alert while they are away. Integrated security systems can provide a huge amount of help when it comes to the emergency situation. For example, the homeowner would not only be alarmed with a notification of a fire alarm but also the system which is integrated would unlock the doors so the residents could run and it would also dial the fire department immediately and light the path to safety. Furthermore, as Roblin and Kim (2010) state that smart homes are also eco-friendly and sustainable because they provide some energy efficiency savings, it could be of a great 'financial help' to the owners of private accommodation. When a person leaves a room, the lights are automatically turned off so that the electric bills go down. Same is with the cooling and heating. Some of the 'smart' devices can track the usage of the energy and command it to use less if it exceeds the limit.

As mentioned before, smart homes provide a huge benefit for an elderly people if they are live alone. It is able to notify the resident about the time to take a medicine. If it happens that a person falls down, it can alert the hospital immediately.

There were numerous cases when guests forgot to turn off the water when filling the tub, but in case of smart home, it would shut off the water before a tub overflowed. The same case is with the oven if the cook forgets to turn it off. Systems which are integrated into the house are also of

a huge benefit for those with disabilities or a limited range of movement (voice control).

Benefits of Smart Technology in Private Accommodation

Based on the literature review, the IoT (Internet of Things) has transformed the way people interact with their homes and properties because nowadays more and more 'smart' products are entering the market. The landlord's job, aside from everything, requires on-site visits to the property in order to check and inspect the condition of appliances and cleanliness of common areas. Since 'the time is money', smart technology could be of a great help in these circumstances. Aside from just improving the value of the property, it has some benefits that actually help the property owner. Home automation adds a higher security to the property. Adding cameras and sensors give the property owner a 'peace of mind' because he can monitor everything that happens inside and outside the property. It can mitigate and prevent potential events that can cause structural issues but also help to protect the property from unwanted intrusions (burglary). The next things is 'Smart Lock'. It basically allows the property owner to lock or unlock the doors through the authorized device (smartphone, tablet...) using a wireless protocol. It also provides extra convenience in allowing guests in and out without being physically there.

Another thing is that smart home technology reduces energy costs. According to Robles and Kim (2010), smart homes also provide some energy efficiency savings. Because some systems are able to put some devices at a reduced level of functionality, they can go to "sleep" and wake up when commands are given.

Furthermore, government subsidies and tax benefits for going greener are also some of the advantages of implementing the smart system into a private property.

Barriers to Become Smart

Rosanna Leung (2017) where she conducted an interview with hotel management about smart systems and its barriers. Although it was conducted for the hotel perspective, this also could be used for a private accommodation.

The first barrier that is considered in this term is financial barrier. There where interviewees who agreed that smart systems are very expensive. Some of them also mentioned that there needs to be a careful calculation and good justification before doing a purchase of smart system. Also, they said that they firstly want to see the ROI for purchasing the smart system. Furthermore, they were worried about how long the smart system could last due to the fact that technology changes so fast. Because of that, the equipment which is bought could be obsolete in one or two years.

Another barrier is ''dependency on internet''. The basic requirement for the smart system is the Internet. It is a fact that without a strong and good internet connection, the home owner or guest will not be in a full control of a property. If there is no internet connection, there is also no other way of accessing to a system and controlling it.

Furthermore, there is a barrier of dependency on professionals. If there is some problem with the smart system or some smart appliances, the home owner cannot just call a handyman or someone who is not professional to try to fix it or manage the bug. The homeowner will have to depend on the company professionals which also can be expensive.

Last but not least is vulnerability/security. Since the smart system depends and is connected to the internet, the chances for being hacked are high.

METHODOLOGY

The purpose of the primary research was to find out what is the future of 'smart houses' in private accommodation in Dubrovnik. Also, the research investigated how much people are familiar with the term 'smart house'. The intention was to determine if the owners of private accommodation are informed and educated enough in the field of modern technology ('smart houses') and how likely are they to implement it in their rental properties. The collected data was a combination of quantitative and qualitative data. It was mostly quantitative since the survey had one open-ended (opinion) question at the end. Before distributing the final survey, the pilot testing was conducted in a small group of family and friends in order to determine if wording of the survey was understandable considering the topic is not widely known.

Participants of this survey were the owners of private accommodation in Dubrovnik. This population was selected because they own private accommodation and are familiar with the terms of renting the property. Sample size was 50. The participants were chosen based on convenient sample of local apartment renters known to the author. Electronic survey was distributed between March and April. Out of 50 participants 37 were male and 13 of them were female.

The survey consisted of eleven questions out of which six were based on a multiple-choice method, two were about demographics (gender, age), two Likert-scale method and one open-ended question (opinion on the topic of 'smart technology'). The questions for the survey were found on the Internet and were modified and adjusted for the needs of this research project. The questions were taken from the research by Ana Carina Freire Margarido (''The impact of technological amenities on customer experience in upscale hotels'', 2015.).

The questions based on a Likert-scale method were about the interest of implementing the

components of 'smart technology' in their apartments (control via mobile application). The scale was from 1-5. 1-I'm not interested at all, 2- I'm not interested, 3- I'm indecisive, 4- I'm interested, 5-I'm very interested. Some of the technologies listed were: lighting, security, smoke and gas leak sensor, energy consumption etc. The questions of multiple-choice method were mostly about the opinion and knowledge the participants had on the topic of 'smart technology' in general. The participants were asked to agree or disagree to the statement. Possible answers were: Strongly agree, agree, neither agree or disagree, disagree, strongly disagree. In addition, there was one question based on the actual amount of money participants were willing to pay for implementing the 'smart technology' into their private accommodation. Since the research was conducted on the local people of Dubrovnik, the survey was distributed electronically in Croatian language.

RESULTS

During the research, 50 electronic surveys were distributed and all of them were submitted and completed. As analysis method, simple statistical analysis was used in order to measure the percentages of each answer. Filtering of the results was used in order to make more detailed analysis of differences between different demographic groups with an emphasis on the age of participants.

Mean and standard deviation was calculated in order to see which questions were "leaning" towards positive or negative answers. In the first five questions, participants were asked to agree or disagree with the statements in order to see whether they are familiar with the topic of "smart technology" and even to test their knowledge on it.

With the statement "I am familiar with the technology of 'smart houses', 24% of the participants strongly agreed to it and 46% agreed. 8% said that they did not agree and 22% said that they neither agreed nor disagreed. Mean was (M=3.9) which means that the answers were positive and that they are mostly familiar with the topic. This question is very important since it supports the first part of the hypothesis which is the "familiarity" with the topic of 'smart tech'. (FIGURE 1)

The question that is also dealing with the hypothesis is the amount of money the owners of private accommodation are willing to spend on buying and implementing 'smart home technology' in their apartments. 12 % of participants said that they were willing to spend up to 3000 kn, 32% up to 7500 kn, 34% up to 10 000 kn and 22% are willing to spend more than 15 000kn. (M=2.7, SD= 0.97). There are variety of answers but also, since some of the systems of 'smart tech' could cost way more than 15 000 kn, it can be concluded that the participants are not willing to spend much on implementing 'smart tech' into their apartments. This also supports our

hypothesis that the reason of not spending money on it could be the current pandemic of Covid-19 or because of the high costs of this system in general. (FIGURE 2)

Furthermore, on the statement "For me it is important to stay 'connected' with my private property while I am not present", results concluded that the majority of people agreed to this. 26% of participants strongly agreed, 56% agreed and only 2% said that it was not important for them to stay connected to their private accommodation. Also, mean in this question was 4.02 so it can be concluded that for the majority of participants it is important to know what is happening in their apartment.

When asked whether they think that the 'smart home' technology affects guests' decision when choosing a private accommodation, majority of participants were neutral (they neither agreed nor disagreed 40%), 14% said that they did not agree and the rest (46%) agreed. In this question the mean still equals 3.4 so it can be concluded that they were leaning towards the positive answer but they were still unsure whether this technology influences guest's decision of choosing the apartment.

Next question was about their interest of implementing such technology into their private accommodation. Some components were listed and they were asked to choose what is the most important for them. The most important component for them was the sensor for smoke and gas leaking (M=4.74), and 78% of participants strongly agreed to this. (FIGURE 3). Energy consumption (M=4.6) (FIGURE 4), and smart lock for self-check in/check out (M=4.4) (FIGURE 5) were very important factors as well. On the both questions 68% of participants strongly agreed to this. Other components were also considered as important but not as much as important as the first three. The least important components were motion sensor and sensor for

wind and rain, but also the mean was 3.6 for the first one and for the second one was 3.4, so we can also conclude that they are leaning towards positive answer (important segment).

Furthermore, the participants were asked to rate the main goals of implementing 'smart technology' in the private accommodation based on their opinion. This question had components such as: improving guest satisfaction and experience, improving security, increase in profit, cost reduction and increase in the occupancy of private accommodation. The participants strongly agreed to each component. The most important goal for implementing 'smart technology' according to the answers of participants was improving the security (70% participants strongly agreed) (FIGURE 6). This response was a bit of surprise because Dubrovnik is perceived as a very safe destination. The second important segment is improving guest satisfaction and experience (54% strongly agreed) (FIGURE 8) and the third important segment was increase in profit (50% strongly agreed).

This research also had qualitative results since participants were asked to give their opinion on the topic of 'smart home' technology and its future in Dubrovnik. There were 16 responses and majority of them were positive. Few of the most important and interesting answers were: "I think that this is a smart investment", "It is a trend that is coming and it will be of increasing importance", "Smart homes are still not so represented in Dubrovnik, but I think that this will change in the future because of the many advantages they offer", "Smart houses" will be increasingly represented in Dubrovnik in the future". Also, there was one response where participant claimed that people in Dubrovnik would not be investing in this system in the future because they are not educated enough about this topic. Qualitative results will be evaluated more thoroughly in the discussion section.

DISCUSSION

Considering analyzed results from the research, it is noticeable that participants (private accommodation owners) have positive attitude towards the topic of 'smart home' technology in private rental properties and they think that this will be the future in this industry. Since the hypothesis of this research was: "The owners of private accommodation in Dubrovnik are familiar with "smart home technology", but due to the high costs of implementing this system and because of the situation with the pandemic of Covid-19, they will not be willing to buy or spend much money on it", the findings slightly match and support it. Although, the results showed that the majority of participants are familiar with this topic of "smart technology", it would be of great help if city of Dubrovnik or tourist board created panels or programs that would educate people more about this topic. In this way, due to the fact that this is a growing industry, not only the owners of private accommodation but the whole community could benefit. Furthermore, the second part of hypothesis deals with the situation of Covid-19 pandemic and the financial status of individuals. Although the results showed that some private accommodation owners were willing to spend more and some less, overall, their willingness to spend on "smart technology" is far below some "serious" investment to this system since the cost of implementing can grow way more than 15000kn which was stated in the one of the questions in a survey. This could be the result of the pandemic of Covid-19 but it does not have to be. Due to the current Covid-19 situation, it would be recommendable to do further researches about this topic when the pandemic situation passes. This topic is somehow new and not many same researches could be found. There is a lot of research about 'smart home' technology in general, about its application in hotel industry but not for rental properties. Nevertheless, it is a fact that the 'smart home' technology could improve the guest satisfaction and experience as well as provide many benefits for the

owner of private accommodation as it was stated in the literature review.

Since this is a growing industry and more and more private rental properties will have some components of 'smart home' system integrated, some actions for educating the individuals should be done. It would not only educate the owners of private accommodation but it could encourage some investors to open a business which would be doing the projects, supervision and integration of this system into private properties.

In addition, it can be assumed that the world will never be the same after the Covid-19 pandemic, as well as the tourism and its many practices in it in general. The system of 'smart home' technology could be of a great help and benefit when it comes to the non-contact check-in/check-out since it all could be done through mobile device connected to IoT (Internet of Things). In terms of qualitative data and the responses that were collected through a survey, majority of answers were positive. They think that this is a smart and important investment and that this is a 'trend' that is coming and will be represented more and more in the future. All answers were 'positive' except one participant who said that people in Dubrovnik would not invest that much into this in the future because they are not educated enough about it. Furthermore, one participant said that this would help in the environmental protection (eco-friendly) and it supports the research since in the literature review, according to Roblin and Kim (2010) smart homes are eco-friendly and sustainable because they provide certain energy efficiency savings. Furthermore, it is interesting that some participants were aware that people should be educated more about this and that every private property should have 'smart home' components. This also supports the research questions of familiarity with the topic.

If this becomes the segment in which private accommodation owners will be dealing with

competitive advantage, more focus needs to be on this topic, since it is well known that this is becoming a growing trend and the billions of dollars are invested into this.

Few limitations of this survey were recognized. Majority of participants were male because of the convenience sampling which included individuals personally known to the author. The fact that this was a convenience sampling, the results could be significantly different if the survey was distributed somewhere else and not in Dubrovnik. Furthermore, since there was a question; ''how much are you willing to spend on buying and implementing the 'Smart Technology' in your private accommodation, the answers could be also different if there was not the pandemic of Covid-19. Another possible limitation is small sample size. The results could be different if more people were questioned.

Future research should be done with same or similar methods but using the higher number of participants. This research could also be done in different cities in Croatia but also in some other countries in order to see whether the results will be different, especially in terms of familiarity with the topic of 'smart homes'.

This research was done due to the fact that this is a very relevant and important topic today since the technology 'rules' the world and it entered in all the industries as well as tourism. In the terms of 'smart home', as technology development continues to expand, so will many possibilities both for the owner of private accommodation and guests in order to make life and vacation more enjoyable and simpler. Furthermore, guests who are disabled or elderly could benefit the most from this system of 'smart home' technology since it is controllable through mobile device. These systems could offer, to those who are less mobile, or have some health problems, the opportunity to be independent and make vacation more suitable for them.

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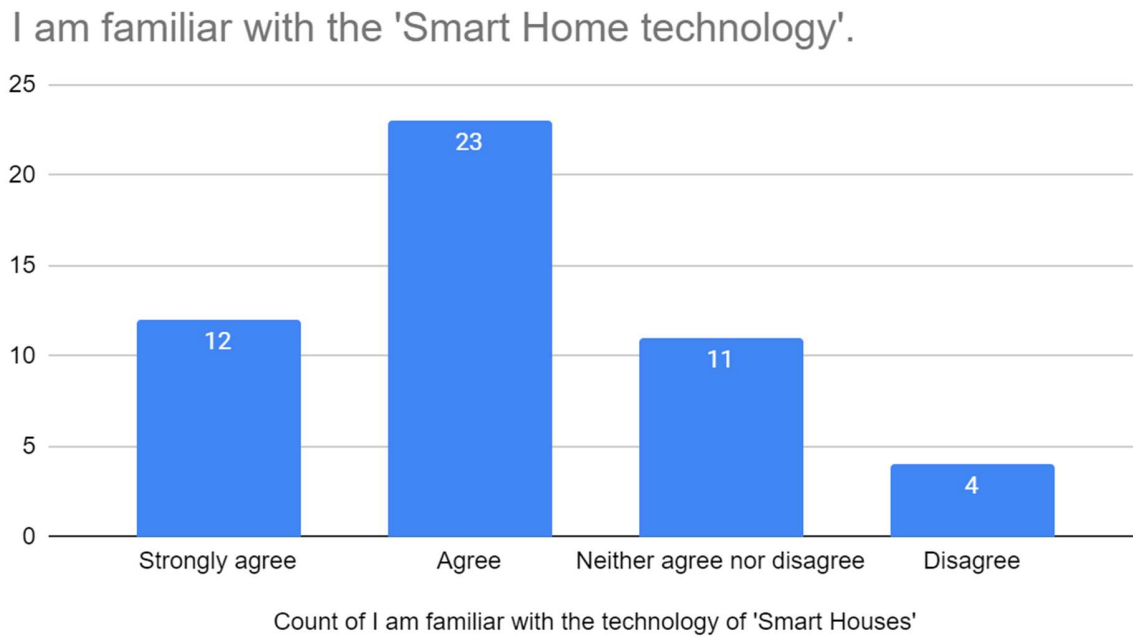
Appendix

I am familiar with the 'Smart Home technology'.

Count of I am familiar with the technology of 'Smart Houses'
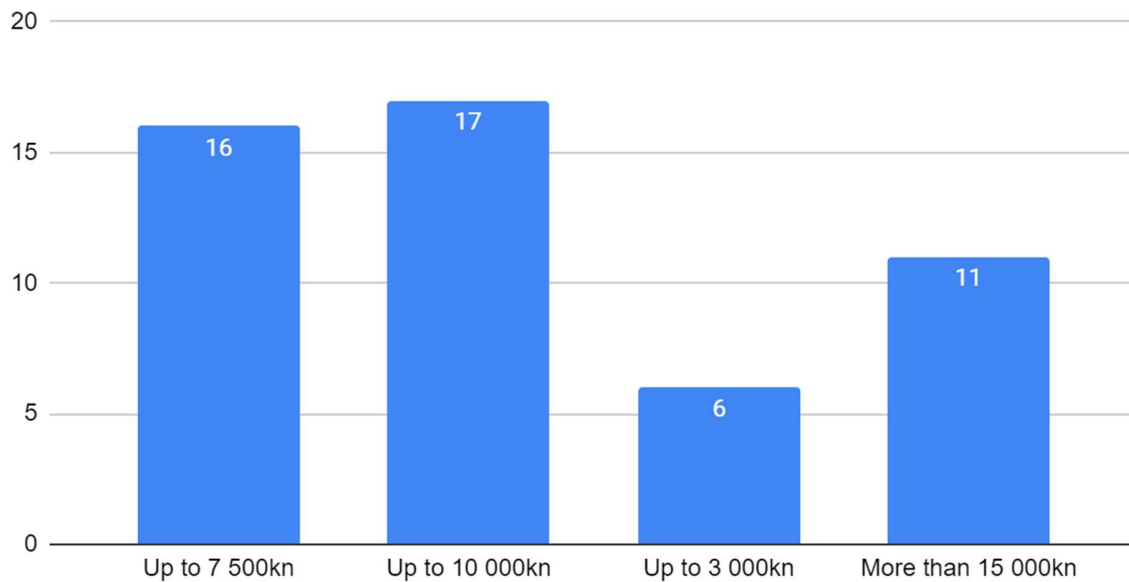
FIGURE 1-Familiarity with 'smart home technology'

FIGURE 2-The amount of money participants are willing to spend on the 'smart home technology'

Sensors for smoke and gas leaking

50 responses

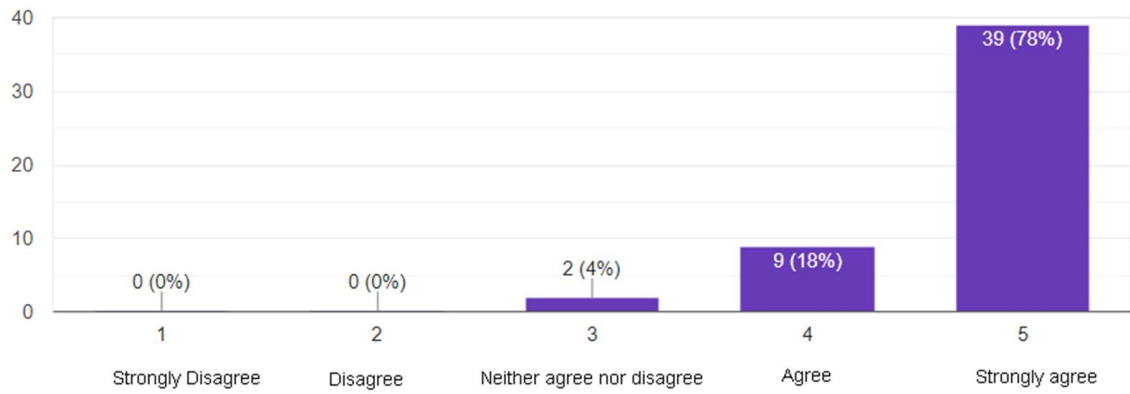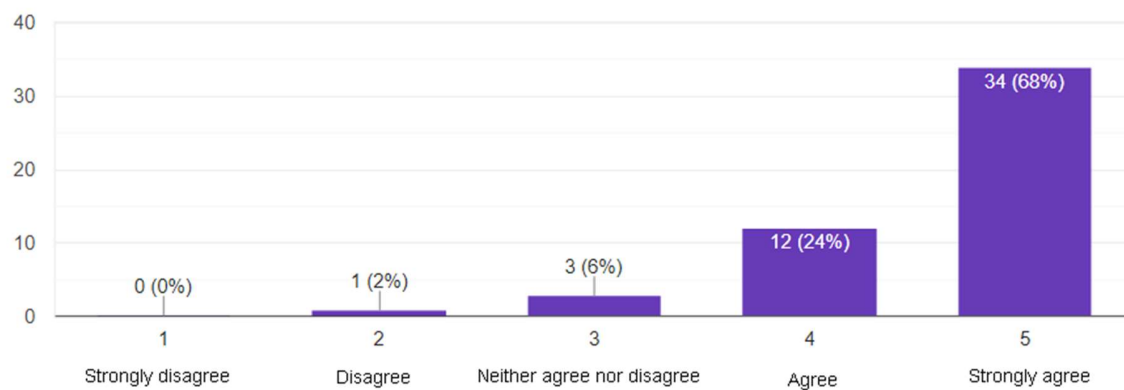FIGURE 3

Energy consumption

50 responses
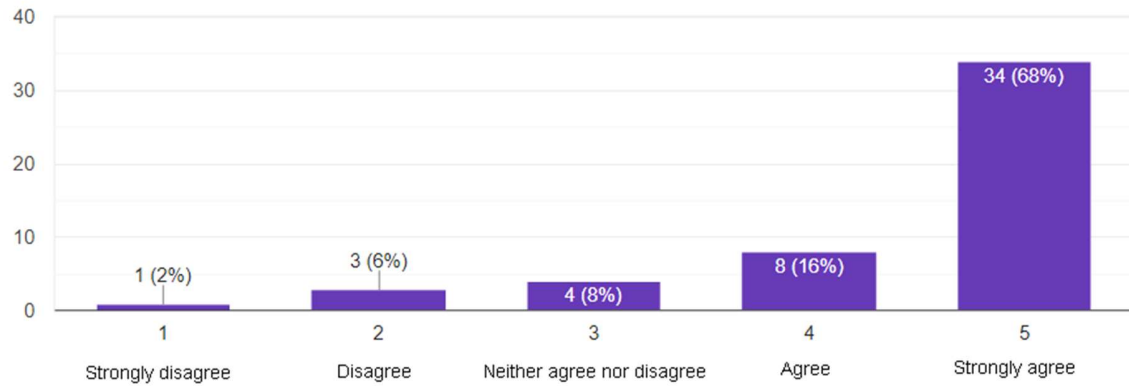
FIGURE 4

Smart lock for check in/check out
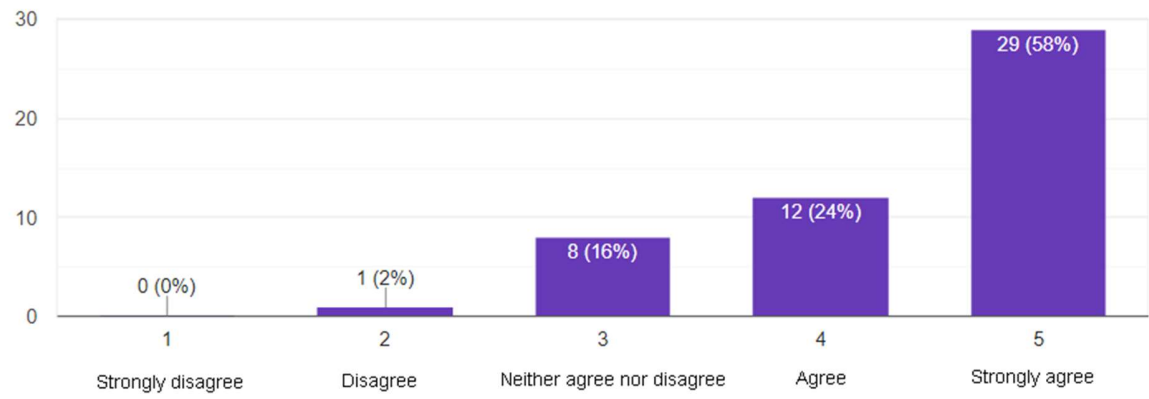
50 responses

FIGURE 5

Security (cameras)

50 responses

FIGURE 6