

Survey Analysis of Building Automation & the Factors Affecting its Acceptance into Indian Households

Daniel Mannhem¹, Gagan Singh Chandhok², Sarang Joshi³

^{1,2} UG Student/Symbiosis Skills and Professional University, Pune, India

³ Assistant Professor/Symbiosis Skills and Professional University, Pune, India

Abstract - Building Automation is in its simplest definition can be described as the centralized control of a buildings heating, ventilation, air conditioning, lighting, and other systems. This study aims to conduct a comprehensive Survey Analysis and tries to highlight the factors that has affected its acceptance into Indian Households. Even though Building Automation is a very renowned field of technology, it has not been able enter into the direct consumers homes. This study aims to collect credible information from a group of 75 people, analyze this information and relate them to models that would help establish relevant factors that influence the technologies acceptance into the Indian marketplace.

I. INTRODUCTION

As per KMC Article “Building Automation: What is it?”, dated July 21st 2015, the main purpose of Building Automation is to improve occupant comfort, the efficiency of building systems, and to reduce energy consumption and operating costs. Building Automation reduced the involvement of humans in a building’s fundamental processes. Just like other forms of Automation, Building Automation consists of various transducers that detect various parameters and using that data necessary actions are performed. It consists of a centralized hub, called the BMS – Building Management System.

In recent years various developments have taken place in this field. Most of these are consumer oriented, allowing a great flexibility in the degree of personalization this technology has to offer to the customers. However, this form of technology is not so prevalent in India, with many Indian households using the more traditional approach towards Building Management and Home Processes. The aim of the study is to being a consumer perspective to analyze the current scenario of Building and Home Automation in

Indian Households and list the major factors that influence this.

II. METHODOLOGY

A survey consisting of 75 participants was conducted on a reliable online platform. The participants were from a mixed batch of age groups and fields of education, so as to improve the range of the participating group as Building Automation is a rather niche field of technology. As for the same reason, they were given a brief introduction about Building Automation –

“Building Automation Technologies -

A Building Automation System utilizes a control system to automate the control of various building systems, like security, ventilation, lighting etc. The Building Automation System (BAS) provides a user interface that allows the end user to adjust the control settings, view the system status, and detect any potential issues related to building system performance.

This way the automation system is delivering you crucial information on the operational performance of a building as well as enhancing the safety and comfort of the occupants.

A centralized Building Automation System brings all of these parts together”.

The survey consisted of 5 sections. Section 1 and 2 was their consent to participating in the survey and their personal details respectively. Intrapersonal Details of the participants were gathered in Section 3 of the survey. Intrapersonal Details included their thinking and thoughts regarding technology as a whole and established a link between the participants psychological attitude towards technology. Section 4 of the survey consisted of questions pertaining to Building Automation and established the familiarity of

such technologies with the participants of the survey. This enabled the collaborators to understand the general public view of the Building Automation as a whole and the reasons why the participants have adapted to these technologies or not, and if not, what could be the possible reasons in not doing so. Section 5 also established a direct correlation between the participants and their likeliness of investing in Building Automation Technologies based of their knowledge and general understanding of this field. The data provided by the s participants was processed, analyzed and scrutinized. On the basis of the data provided by the participants, meaningful conclusions were drawn.

III. PURPOSE

The purpose of this study is to examine various factors that play a crucial role in inculcating Building and Home Automation Technologies into Indian Households, such as (but not restricted to) cost, availability of technology, expertise of operating and installation, user friendliness and other such factors. The purpose of this study is to also examine the current scenario of Building Automation Technologies in the Indian Marketplace.

IV. RESULTS

This study has enabled the authors to understand that Building Automation Technologies, though very widely present is still a very niche form of technology to the direct consumer. It is a very prevalent form of technology which most of the people have come across at least once in their lives. Yet however these systems have not been very successful in penetrating into the homes of the direct customer. The direct customer is forced to take into considering a variety of factors which would affect their judgement about Building Automation Technologies, in turn affecting their will to procure and use such technologies. The major factors that affect the direct customer are - a. the logistics involved in such technologies, b. their familiarity with such technologies, c. monetary expenses involved in investing in these technologies, along with psychometric factors like - a. the customers perceived usefulness, b. perceived ease of use and c. their general attitude towards such a technology.

V. SURVEY ANALYSIS

A. Participants Background

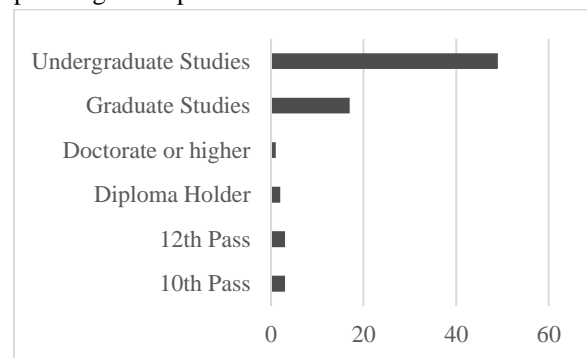
There was a total of 75 participants for the study who gave their inputs regarding Building Automation. This study also took into consideration various attributes of the survey participants like – Age, Educational Qualification, Educational Domain, Environmental Setting etc. This enables the authors of this study to understand the participants better to draw more comprehensive results and establish links between certain parameters that would subconsciously affect their outlook on Building and Home Automation.

1. Age –

The Average age of the total participants was found out to be 23 years. This signifies that a majority of the participants were young adults. According to the authors of “Factors Predicting the Use of Technology: Findings from the Center for Research and Education on Aging and Technology Enhancement (CREATE)”, age not only has a direct link with the reliance of a particular technology but also corresponds to how fast or slow one particular age group is in learning or adapting to such a technology.

2. Educational Qualification –

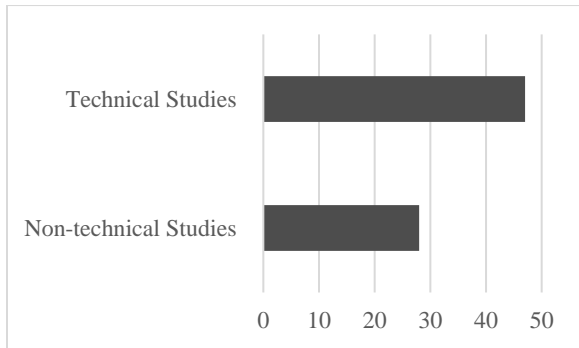
The Educational Qualification was divided among six main categories- Doctorate or Higher, Graduate Studies, Undergraduate Studies, Diploma Studies, 12th Pass and 10th Pass. A total of 49 out of 75 participants were found to have completed/completing Undergraduate Studies, which accounts to 65.3% of the total participants. 17 participants were found to be perusing/ have perused Graduate Studies (22.6%), 1 participant perusing/ have perused Doctorate or Higher (1.33%), 2 participants perusing/ have perused Diploma (2.66%), 3 participants perusing/ have perused 12th Grade (3.99%) and 3 participants perusing/ have perused 10th Grade Studies.



Response Graph 1 – Educational Qualifications

3. Educational Domain –

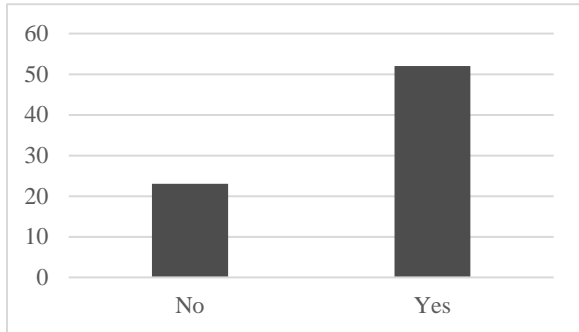
It was found out that a total of 47 participants belonged to the Technical Education domain (62.66%), whereas the remaining, 28 participants belonged to the Non-Technical Education Domain (37.33%).



Response Graph 2 - Educational Domain

4. Career Domain –

A majority of 52 participants were following a career in their respective education domain (69.33%) and the other 23 were not following a career in their respective education domain (30.66%)

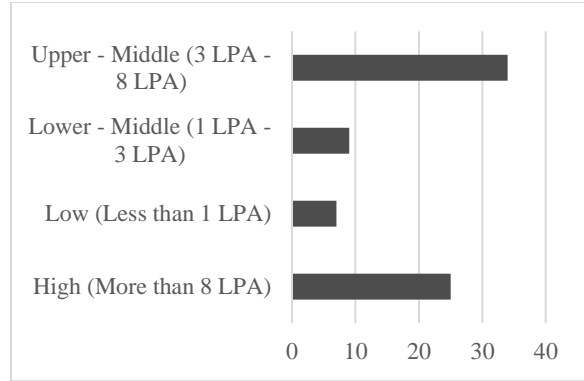


Response Graph 3 - Career Domain

5. Economic Status –

A total of four options of Economic Status were given to the participants to choose from– High (Income more than 8 LPA), Higher Middle (Income between 8-3 LPA), Lower Middle (Income between 3-1 LPA), Low (less than 1 LPA). If participants were not earning members of the household, they were asked to choose from their dependent’s income value.

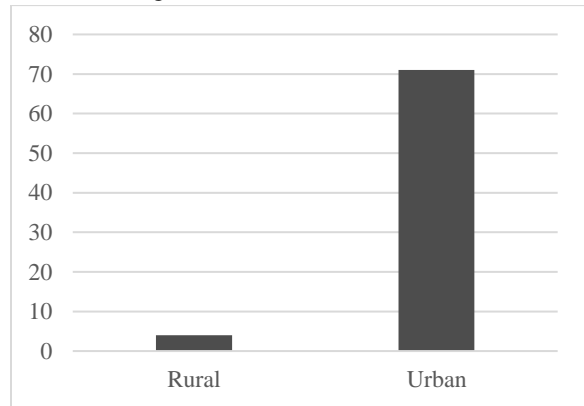
A total of 25 participants belonged to the High category (33.33%), 34 participants belonged to the Upper Middle category (45.33%), 9 participants belonged to the Lower Middle category (12.00%) and 7 participants in the Low-Income category (9.33%).



Response Graph 4 - Economic Status

6. Environmental Setting –

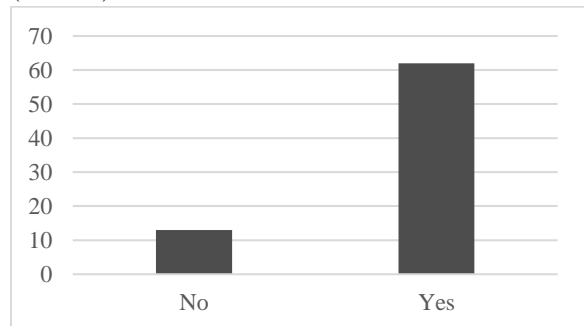
It was observed that 71 participants belonged to a Urban setting (94.66%) and 4 participants belonged to a Rural setting (5.33%).



Response Graph 5 - Environmental Setting

7. Ownership of Dwelling –

The participants were asked to confirm whether they owned a residential dwelling.62 participants in this study owned a residential dwelling (82.66%). 13 participants did not own a residential dwelling (17.33%).

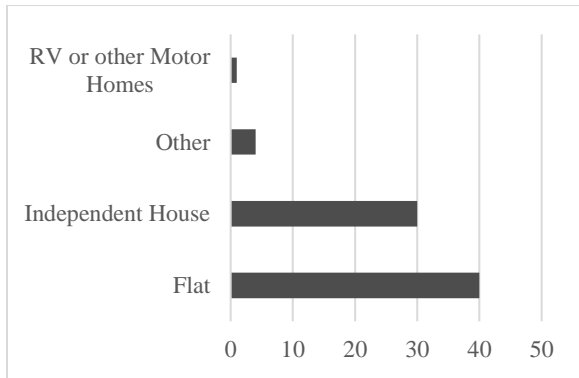


Response Graph 6 - Ownership of Dwelling

8. Type of Residential Dwelling –

The participants were asked to fill in the type of residential dwelling they live in. A majority of participants, 40, reside in Flats (53.33%). 30

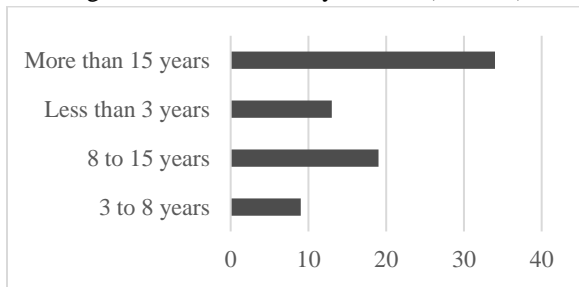
participants reside in Independent Houses (40.00%). 1 person resides in a RV or Motor Home (1.33%) and a total of 4 persons reside in other type of dwellings (5.33%).



Response Graph 7 - Type of Residential Dwelling

9. Age of Residential Dwelling –

34 participants lived in residential dwellings that are more than 15 years old (45.33%), 19 participants lived in residential dwellings that belong to the age range of 8 to 15 years (25.33%), 9 participants lived in residential dwellings that belong to the age range of 3 to 8 years (12.00%). 13 participants lived in residential dwellings that are less than 3 years old (17.33%).



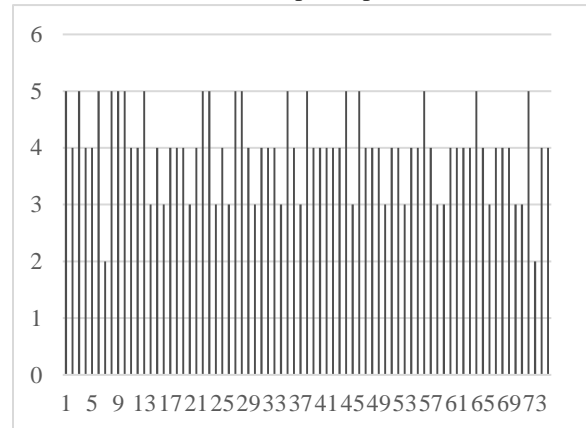
Response Graph 8 - Age of Residential Dwelling

B. Participants Dependency on Technology

Participants were asked a set of five questions that highlighted their dependency on the latest forms of technology. An overall score was calculated for each of the five questions that enabled the authors to understand the collective dependency of the participants on the latest forms of technology. This enabled the authors to establish a link between the participants general dependency on smart technology and their dependency on Home and Building Automation technologies. The five questions are as follows –

1. “On a scale of 1-5 how 'Technologically Updated' are you?”

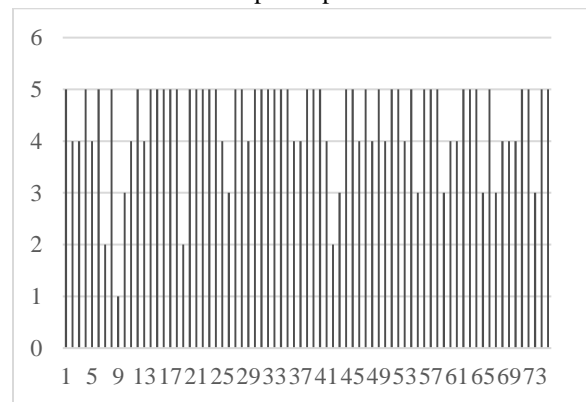
A scale of 1 to 5 was offered to the participants where the number 1 signified least updated and the number 5 signified most updated. It was found out that the total collective score of the participants was 3.97/5.0.



Response Graph 9 - “On a scale of 1-5 how 'Technologically Updated' are you?”

2. “How often do you use smart devices (E.g. - smartphone, smartwatch etc.) to accomplish daily tasks?”

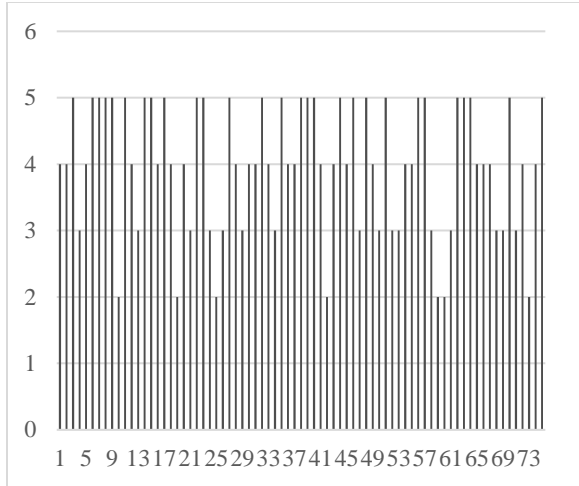
A scale of 1 to 5 was offered to the participants where the number 1 signified least often and the number 5 signified most often. It was found out that the total collective score of the participants was 4.36/5.0.



Response Graph 10 - “How often do you use smart devices (Eg - smartphone, smartwatch etc) to accomplish daily tasks?”

3. “Do you feel that it is necessary to use the latest technologies to accomplish general tasks?”

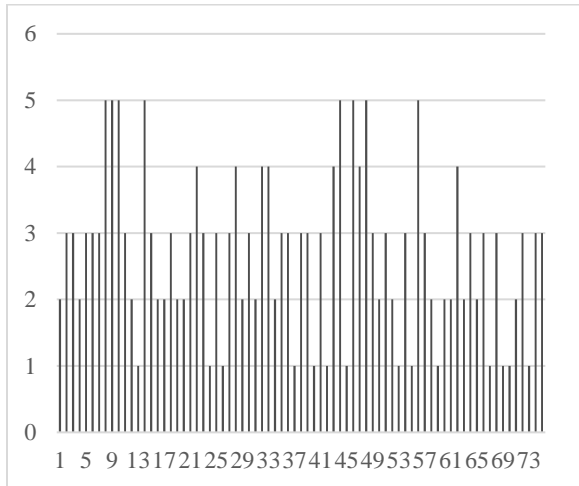
A scale of 1 to 5 was offered to the participants where the number 1 signified least necessary and the number 5 signified most necessary. It was found out that the total collective score of the participants was 3.97/5.0.



Response Graph 11 - “Do you feel that it is necessary to use the latest technologies to accomplish general tasks?”

4. “Do you find it necessary to buy the latest version of smart devices (eg smartphone, smartwatch etc) as soon as it releases?”

A scale of 1 to 5 was offered to the participants where the number 1 signified least necessary and the number 5 signified most necessary. It was found out that the total collective score of the participants was 2.69/5.

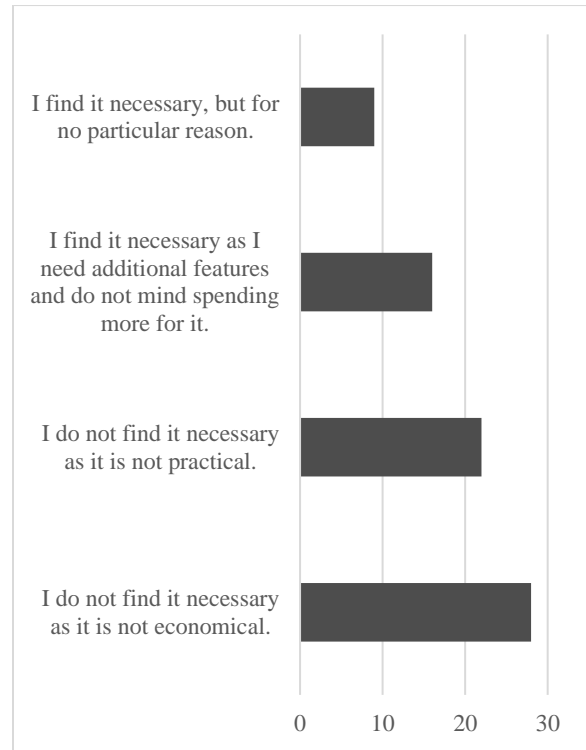


Response Graph 12 - “Do you find it necessary to buy the latest version of smart devices (eg smartphone, smartwatch etc) as soon as it releases?”

5. “Why do you find it necessary or not necessary to buy the latest version of smart devices?”

It was noted that 28 participants did not find it necessary as it was not economical (37.33%), 22 participants did not find it necessary as it was not practical (29.33%), 16 participants found it necessary

as they required the additional features and would not mind spending more for it (21.33%). Only 9 participants found it necessary but for absolutely no reason (12.00%).



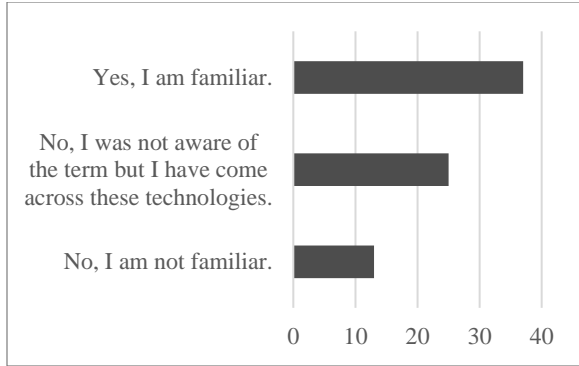
Response Graph 13 - “Why do you find it necessary or not necessary to buy the latest version of smart devices?”

C. Participants and their Outlook on Building & Home Automation

The participants were asked a series of questions that were directly and indirectly related to their outlook on Building and Home Automation. These questions were intended to understand the participants past experiences and beliefs of Building Automation Technologies. These questions took into account the participants general knowledge about Building Automation Technologies and the application of such technologies in the houses of the participants.

1. “Are you familiar about the term 'Building Automation'?”

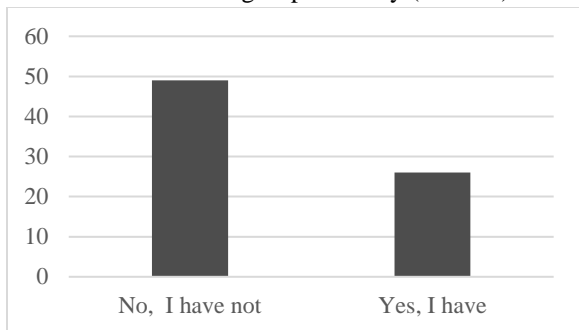
It was noted that 37 out of the total 75 were familiar with the term Building Automation (49.33%). 25 participants were not familiar with the term but have come across such technologies (33.33%). A total of 13 participants were not at all familiar with the term Building Automation (17.33%).



Response Graph 14 - “Are you familiar about the term ‘Building Automation?’”

2. “Have you used Building Automation technologies?”

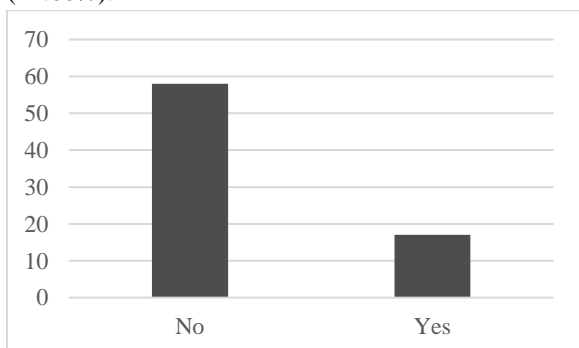
It was found out that 49 participants have not used Building Automation Technologies (65.33%). The remaining 26 participants have used Building Automation Technologies previously (34.66%).



Response Graph 15 - “Have you used Building Automation technologies?”

3. “Is your home equipped with Building Automation technologies?”

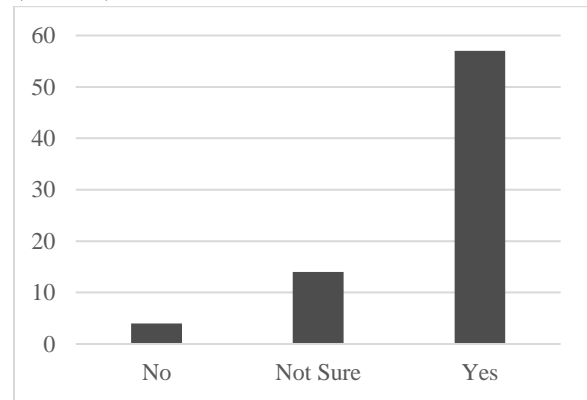
It was noted that 58 participants did not have such technologies installed at their homes (77.33%). Only 17 Participants had Building Automation Technologies installed at their residential dwellings (22.66%).



Response Graph 16 - “Have you used Building Automation technologies?”

4. “Do you believe Building Automation Systems hold additional benefits over traditional technological systems?”

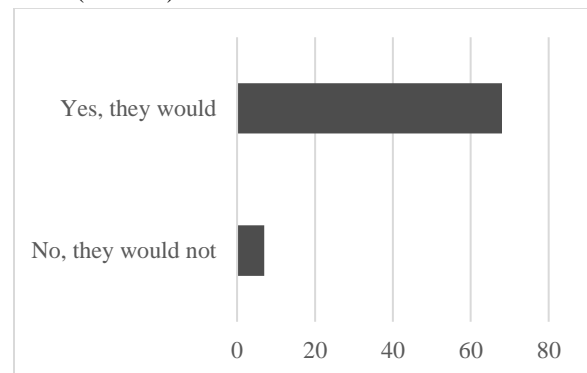
It was observed that 57 participants believed that Building Automation tools do hold additional benefits over traditional systems (76.00%), 4 participants did not believe they hold additional benefits (5.33%), and 14 participants were unsure about the very same (18.66%).



Response Graph 17 - “Do you believe Building Automation Systems hold additional benefits over traditional technological systems?”

5. “Do you believe that Building Automation technologies would help solve a multitude of problems that persist in traditional households?”

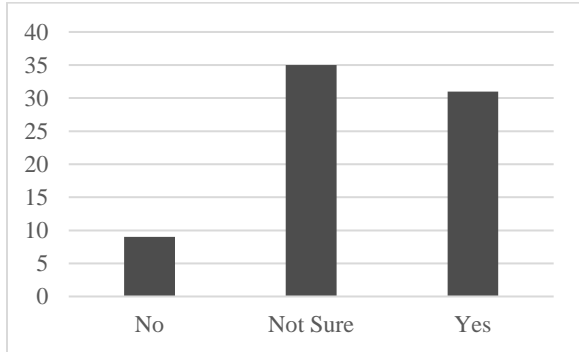
It was observed that 68 participants believed that Building Automation technologies would hold the solutions to problems that persist in traditional households (90.66%). 7 participants did not feel the same (10.33%).



Response Graph 18 - “Do you believe that Building Automation technologies would help solve a multitude of problems that persist in traditional households?”

6. “Do you believe that you are in close proximity to avail Building Automation technologies, if there is a need to?”.

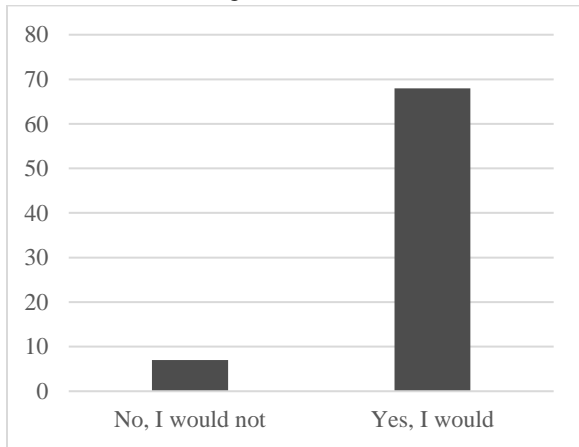
It was noted that a majority of participants, 35, were unsure if they were in close proximity to avail such tools (46.66%). A total of 31 participants believed that they are in close proximity to avail these technologies (41.33%). 9 participants belied that they are not in close proximity to avail these technologies (12.00%)



Response Graph 19 - “Do you believe that you are in close proximity to avail Building Automation technologies, if there is a need to?”.

7. “Would you invest in Building Automation systems bearing in mind that initial investment is significantly greater than that of traditional systems?”

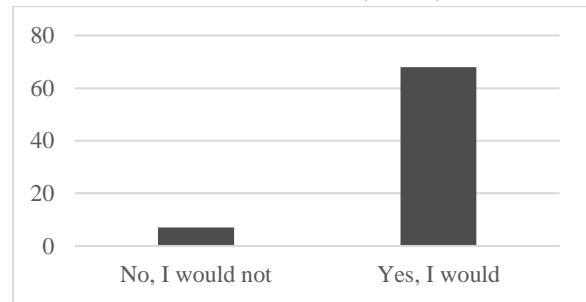
It was observed that 52 participants would have liked to invest in such a technology despite the higher initial investment (69.33%). The remaining 23 participants did not feel like doing so (30.66%).



Response Graph 20 - “Would you invest in Building Automation systems bearing in mind that initial investment is significantly greater than that of traditional systems?”

8. “Assuming that the initial investment of Building Automation Systems is negligible, would you invest in such technologies?”.

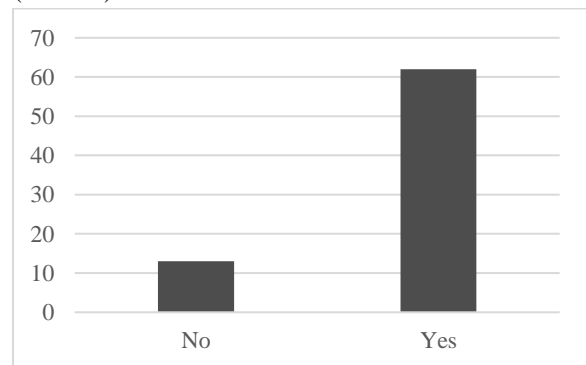
Assuming the contrary with respect to the previous question, the participants were given a hypothetical situation where the cost of investment for Building Automation Technologies was neglected. The participants were then asked if they would like to invest in such Technologies. It was noted that 68 participants would have liked to invest in such technologies (90.66%). The remaining 7 participants would have not wanted to do so (9.33%).



Response Graph 21 – “Assuming that the initial investment of Building Automation Systems is negligible, would you invest in such technologies?”.

9. “Do you believe that Building Automation technologies are easier to use and more user friendly when compared to traditional technologies?”

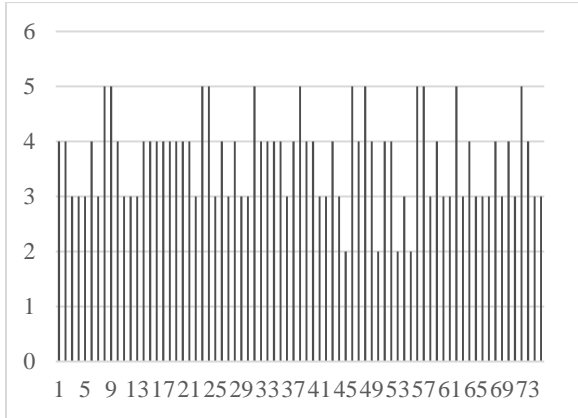
It was noted that 62 participants believed that Building Automation Technologies are easier to use and are more friendly (82.66%). The other 13 participants did not believe that Building Automation Technologies are easier to use than traditional methodologies (17.33%).



Response Graph 22 - “Do you believe that Building Automation technologies are easier to use and more user friendly when compared to traditional technologies?”

10. “How 'practical' of an addition would Building Automation technologies be to an Indian Household?”

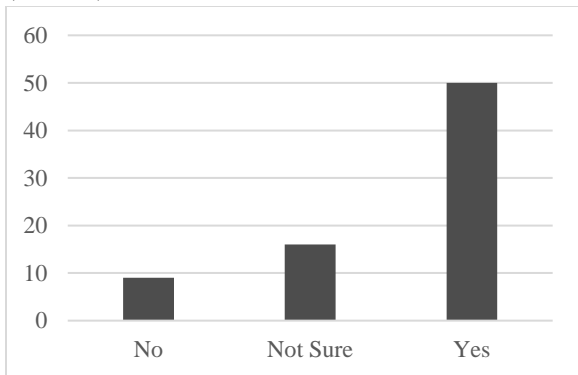
Participants were given an option of 1-5 to choose from with 1 being least practical and 5 being the most practical. A cumulative score was found out for the all the participants. The Collective score was found out be - 3.68.



Response Graph 23 - “How 'practical' of an addition would Building Automation technologies be to an Indian Household?”

11. ” Do you believe that your place of residence (Flat/ Independent house etc.) can be equipped with Building Automation technologies?”

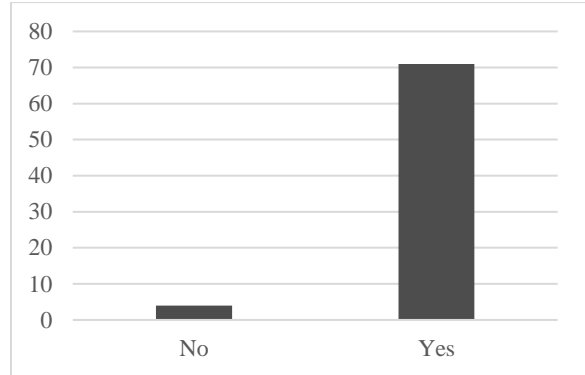
It was observed that 50 participants were sure that their residences could be equipped with Building Automation Technologies (66.66%). 9 Participants felt that Building Automation Technologies could not be installed at their residences (12.00%). 16 Participants were unsure about the very same (21.33%).



Response Graph 24 - ” Do you believe that your place of residence (Flat/ Independent house etc.) can be equipped with Building Automation technologies?”

12. “Do you believe you are in possession of prerequisites that are fundamental to the functioning of Building Automation technologies (e.g., Wi-Fi, Smartphone etc) “?”

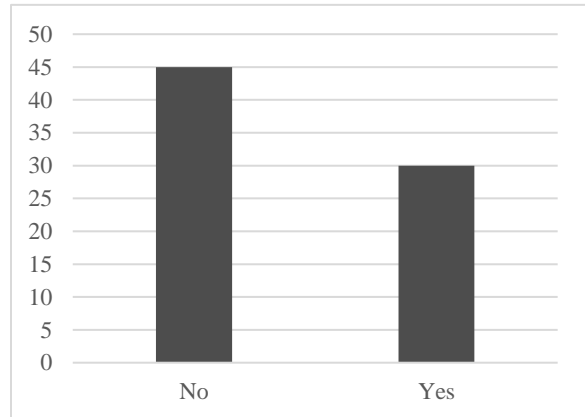
It was noted that 71 participants believed that they owned resources that are fundamental to Building Automation Technologies (94.66%). The rest, 4 participants, did not own such resources (5.33%).



Response Graph 25 - “Do you believe you are in possession of prerequisites that are fundamental to the functioning of Building Automation technologies (e.g., Wi-Fi, Smartphone etc)? “.

13. “Do you own Smart Home modules such as Amazon Alexa, Apple Homepod, Google Nest etc?”

It was concluded that 45 participants did not own any Smart Home modules such as Amazon Alexa etc (60.00%). The remaining 30 participants did own some kind of Smart Home Modules (40.00%).

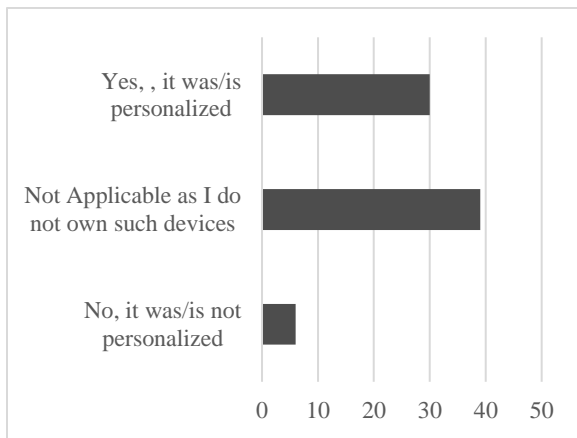


Response Graph 26 - “Do you own Smart Home modules such as Amazon Alexa, Apple Homepod, Google Nest etc.?”

14. “If you own/owned Smart Home modules such as Amazon Alexa, Apple Homepod, Google Nest

etc, do you feel that the experience with such devices was personalized?”

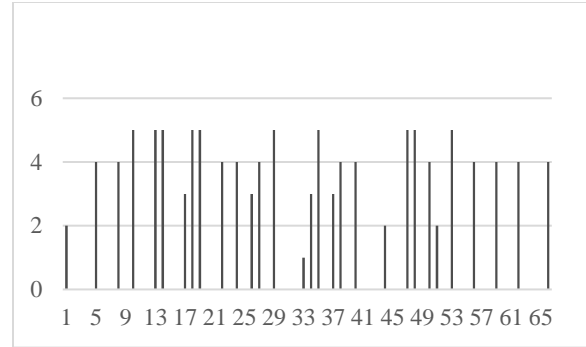
Participants who owned Smart Home Modules (answered “Yes” in the above question), were asked about their experience regarding the personalization these devices could offer. If they felt that the device offered a good degree of personalization, they were to respond by selecting the “Yes” option. It was noted that 30 participants felt that these devices offered them a very personalized experience (40.00%). 6 participants felt that the devices did not offer them a personalized experience (8.00%). This question was not applicable for the remaining 39 participants (52.00%).



Response Graph 27 - “If you own/owned Smart Home modules such as Amazon Alexa, Apple Homepod, Google Nest etc, do you feel that the experience with such devices was personalized?”

15. “If you own/owned Smart Home modules such as Amazon Alexa, Apple Homepod, Google Nest etc, how easy did you find it to set the device up (pairing with your smartphone, allowing Wi-Fi access etc) and run it to perform basic tasks?”

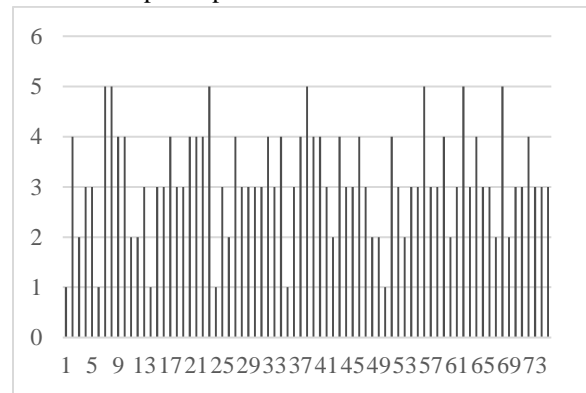
Participants were asked to fill this with the help of a scale of 1-5, where 1 meant very difficult to set up and 5 meant very easy. A collective score was calculated on the basis of the information provided. It was noted that the collective cumulative score is – 3.9.



Response Graph 28 - “If you own/owned Smart Home modules such as Amazon Alexa, Apple Homepod, Google Nest etc, how easy did you find it to set the device up (pairing with your smartphone, allowing WiFi access etc) and run it to perform basic tasks?”

16. “Do you feel that there is need for improvement of the current generation Building Automation technologies?”

A scale of 1 to 5 was offered to the participants where the number 1 signified there is great need for improvement and the number 5 signified no need for improvement. It was found out that the total collective score of the participants was - 3.13.



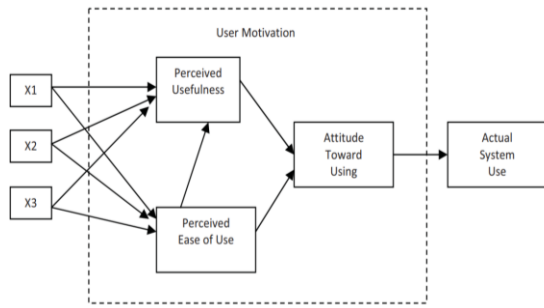
Response Graph 29 - “Do you feel that there is need for improvement of the current generation Building Automation technologies?”

V. INFERENCES

A. Technology Acceptance Model-

The Technology Acceptance Model was first proposed by Fred Davis in 1985 in his doctoral thesis at MIT Sloan School of Management. He proposed that user motivation acts as a major factor that influences the acceptance of a new technology. The user motivation however is influenced by the technology’s features

and capabilities which Davis had described as “external stimulus”.



Original TAM – [1]

Davis suggested that the user’s motivation depends on three key factors – *Perceived Ease of Use, Perceived Usefulness and Attitude Towards Using the System.*

1. Perceived Ease of Use of Building Automation Technologies –

The 75 participants were asked a few questions regarding the user friendliness of Building Automation Technologies in subsections V.C.4,8,14. In subsection V.C.4, the participants were asked if they believed Building Automation Technologies had benefits over other traditional technologies. 57 of the 75 (76%) participants believed that they did have other benefits over traditional Technologies. This means that out of every 100 persons who would experience Building Automation Technologies, 76 persons would feel that they hold benefits over traditional methods. This is further clarified in subsection V.C.9, where the participants were asked if Building Automation Technologies are more user friendly and easier to use than traditional forms of Technology. 62 of the 75 (82.66%) participants believed that Building Automation Technologies are easier to use and are more user friendly than traditional technologies. This signifies that 87 out of 100 persons would feel that Building Automation Technologies are easy to use. In subsection V.C.15, the participants who owned Smart Home Modules were asked their real-life experience about the ease of use of such devices, from setting them up to running basic functions. The total collective score which was calculated by taking an average of the individual scores submitted by the participants within the scale of 1 to 5 suggests that their experience with regard to user friendliness was fairly decent. The total collective score that was calculated was 3.9/5.0, which falls in between the

median rank and relatively closer to the second upper limit score.

2. Perceived Usefulness of Building Automation Technologies –

The 75 participants were asked a few questions regarding the usefulness of Building Automation Technologies (V.C.4, V.C.5, V.C.10).

In subsection V.C.4, the participants were asked if they believed Building Automation Technologies had benefits over other traditional technologies. 57 of the 75 (76%) participants believed that they did have other benefits over traditional Technologies. This means that out of every 100 persons who would experience Building Automation Technologies, 76 persons would feel that they hold benefits over traditional methods.

In subsection V.C.5, the participants were asked if Building Automation Technologies could solve a majority of problems that persists in traditional households directly corresponding to the perceived usefulness of the technology. A total of 68 out of 75 (90.66%) participants believed that these issues would be solved with the inclusion of Building Automation. This means that out of 100 random people 91 people would find Building Automation Technology very useful.

In subsection V.C.10, the practicality of Building Automation was asked to the participants. The participants had to choose from a scale of 1 to 5 and a collective score was calculated by taking an average of the individual scores submitted by the participants. The collective score was calculated to be 3.68. This score signifies that the participants believed that Building Automation Technologies was not the most practical addition to their house, neither was it not at all practical.

1. Attitude Towards Building Automation Technologies –

The overall response of the survey, especially in subsections V.C.1, V.C.2, V.C.7, V.C.8, V.C.9, V.C.11, V.C.16, which took into consideration the participants belief about their knowledge, enthusiasm, and opinion about Building Automation Technologies. However, in practical scenarios, subsection V.C.3 and V.C.13, it was observed that actual investment in Building Automation Technologies did not correspond to the value mentioned above.

B. Other Important Factors –

1. Logistics related to Building Automation Technologies –

Subsections V.A.6 and V.C.6 highlight the logistical constraints of the participants with regard to availing Building Automation Tools in close proximity. Even though a majority, 71 out of the 75 (94.66%) of the participants belonged to an urban settlement it was noted that 35 participants of the total (44.66%) were unsure whether they lived in close proximity to avail such services. Further, only 31 of the 75 participants (41.66%) believed that they are in close proximity to such technologies. 9 participants (12.00%), believed that they are not in close proximity to such technologies.

2. Knowledge and Familiarity of Building Automation to the General Public –

In subsections V.A.2, V.A.3 and V.A.4, the educational details of the participants were asked. It was noted that the group of participants were highly educated with majority, 49 participants (65.33%) of participants completing/ have completed an Undergraduate Degree, and 17 participants (22.66%) completing/ have completed a Master's Degree.

However, in subsections V.C.1 and V.C.2, their knowledge about the terminology "Building Automation" was asked. It was observed that only 37 of the total (49.33%) participants were familiar with the term Building Automation. 25 of the participants (33.33%) were unsure about the terminology but have come across such technologies before. A total of 13 participants (17.33%) were completely unfamiliar about the term Building Automation. In subsection 6.3.2, it was noted that a majority of participants, 49 (65.33%) have not used Building Automation Technologies.

This goes on to prove that despite being a very renowned form of technology, Building Automation has not been able to properly make itself prevailing in the minds of the general consumer.

3. Economics Related to Building & Home Automation –

In subsections V.A.5, V.C.7 and V.3.8 a direct link between monetary expenditure a consumer has to undertake for installation and Building Automation Technologies was tried to be established. It was noted that a significant number (68 out of 75; 90.66%) of

participants belonged to the Middle and Upper income slabs. Yet, when asked if they would like to invest in Building Automation Systems knowing that initial investment would be relatively expensive than traditional systems, only 52 of the 75 (69.33%) would have liked to invest. The remaining 23 participants (30.66%) declined to do so.

However, when asked if the initial cost of investment in Building Automation Technologies was neglected, there was a significant rise in the participants willing to invest in such a technology. 68 (90.66%) participants out of 75 would now like to invest in such a technology. There was an increment of 16 participants. This goes to show that monetary constraints held 16 participants back from investing in Building Automation Technologies.

This means that out of every 100 random persons asked if they would invest in Building & Home Automation Technologies, 21 persons would take into account the monetary expenses involved in such an investment.

VI. CONCLUSION

The authors of this study were able to understand the general opinion of the participants towards Building Automation Technologies. It also enables the authors to list down various factors that influences the opinion of the participants, and thereby of the general public.

VI. ACKNOWLEDGMENT

I would like to thank Symbiosis Skills and Professional University for providing me with an opportunity to research about a new and emerging technology that would surely affect a multitude of people in the coming years. It is my radiant sentiment to place on record my best regards, deepest sense of gratitude to Prof Dr Santosh Sonawane, Director, Symbiosis Skills and Professional University for his careful and precious guidance which was extremely valuable for my study both theoretically and practically. I express honest gratitude towards all the participants who spared valuable time in helping give their priceless inputs during and after filling the survey which would help me put my feet in their shoes and enable me to look at this topic from a different perspective.

REFERENCES

- [1] Mohammad Chuttur — Overview of the Technology Acceptance Model: Origins, Developments and Future Directions, Sept 2009.
- [2] Sara J. Czaja, Neil Charness, Arthur D. Fisk and Christopher Hertzog, Sankaran N. Nair, Wendy A. Rogers, Joseph Sharit - Factors Predicting the Use of Technology: Findings from the Center for Research and Education on Aging and Technology Enhancement (CREATE), July.2006.
- [3] Control Services – What is Building Automation:http://www.controlservices.com/learning_automation.htm.
- [4] PC Lai -The literature Review of Technology Adaptation Models and Theories for Novelty Technology, February 2017.
- [5] Kenneth Yigael Goldberg – What is Automation? January 2012.
- [6] Rohit Chasta, Rajesh Singh, Anita Gehlot, Raj Gaurav Mishra, Sushabhan Choudhury - A Smart Building Automation System, October 2016.
- [7] Jose´ Carlos Martins Rodrigues Pinho, Ana Maria Soares - Examining the technology acceptance model in the adoption of social networks, May 2011.
- [8] Qingxiong Ma, Liping Liu - The Technology Acceptance Model: A Meta-Analysis of Empirical Findings, January 2004.
- [9] Rajwinder Singh - Home Automation System, November 2020.
- [10] Sudhir Kumar, Jitendra Kurmi - Scenario of Home Automation in India, March 2020.