



Senior Citizens Usage Towards and Perception of Modern Technology in India

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Abstract. India is the second largest populated country and one the fast growing developing countries in the world. As we grow up and getting older, problems associated with aging is increasing rapidly – medical, biological, psychological, economic, and social etc. Population ageing and growing number of elderly population demands for healthcare and technology enabled-services. Factors associated with ageing population are essential for to ensure progress in development and sustainability. In response to the rapid population growth, the industry and market for older adults is growing with the introduction of new technology-enabled products and services. The advancement of technology and technology-enabled services are proliferating. However, their rate of adaption is very low. As the society is progressively moving towards digital, there is an increasing risk of excluding users with particular access needs. Among those at risk of digital exclusion are many older people and other differently-abled people for whom the technology is difficult to access. We foresee a great challenge in identifying factors affecting older people adopting new technologies and provide support to aging. To assess senior citizens usage towards and perception of modern technology in India, a survey was conducted with a random sample of 25 participants over 60 years of age using smart phone and living in Bengaluru city. The survey was carried out individually face to face followed by semi-structured interviews. The participants expressed that they are not scared and hesitant to use technology. They are also aware of the value of new technologies and show their willingness to adopt, if it improves their quality of life with security. The implications of the results are discussed in this paper.

Keywords: Senior citizen · Population aging · Technology adoption
Technology usage · Assistive technology · Technology perception

1 Introduction

Population aging is the most significant global phenomenon today. The 20th century has witnessed the increased proportion of aging population in all the countries. In the coming millennium, it is expected to increase further due to the improvement in life expectancy all over the world, particularly public health and medical advancements. Population aging has become the most important social transformation of the 21st century.

By 2050, the elderly population of Asia over 60 years will double by the mid-century reaching to 1.3 billion (United Nations 2015a, b). On the other side steadily declining birth rate and fertility trends, lead to increase in the share of aged in total population of the world and this has brought enormous challenges to many aspects of life.

In India, the proportion of the population aged 60 years and above was 7% (88 million) in 2009 and was projected to increase to 20% (315 million) by the year 2050 (Subaiya and Bansod 2011). The demographics of population aging in India shows that the proportion of population aged 15–59 and 60 years and above are projected to increase while 0–14 years are projected to decline rapidly (Subaiya and Bansod 2011) (see Fig. 1). The United Nations Population Division projects that after the year 2050 the elderly population will outnumber children (United Nations 2010).

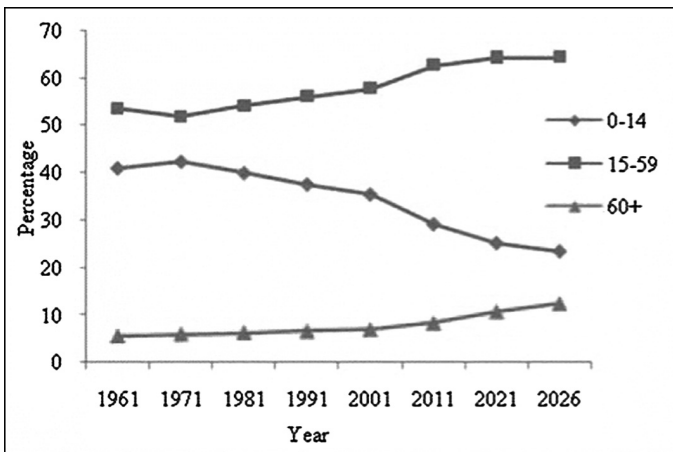


Fig. 1. Population by broad age groups in India, 1961–2026.

The population aging process began in the last century with developed countries and currently encompassing developing countries as well (United Nations 2015a, b). India is not an exception to this aging phenomena. The structure of the population has changed over the years and will further and the proportion of older persons in the population will increase. As we age, problems associated with aging is increasing rapidly – medical, biological, economic, social etc. In the scenario of large elderly population, the country needs more technology-enabled health care services, facilities and resources.

In response to the rapid population growth, the industry and market for older adults is growing with the introduction of new technology-enabled products and services. However, their rate of adaption is very low. As the society is progressively moving towards digital, there is an increasing risk of excluding users with particular access needs (Milne et al. 2005). Among those at risk of digital exclusion are many older people and other differently-abled people for whom the technology is difficult to access. We foresee a great challenge in identifying factors affecting older people adopting new technologies and provide support to aging.

Elderly users are progressively limited in their ability to use and access information due to multiplicative effects might come with increasing age factor. Many older people are having difficulties in using modern smart devices due to increased complexity in accessing information both in terms of functionality and interface design. Research shows that older people have more difficulty in using touch interfaces in comparison to the younger population (Page 2014). The world demography shows that due to various developments a proportional increase of older people engaged in effective use of technology to lead independent life. Population ageing and growing number of elderly population demands for care and technology enabled-services. Factors associated with ageing population are essential for to ensure progress in development and sustainability.

In this context, an important fact which needs to greater attention is that in the developing countries like India, older persons are increasingly living independently due disintegration of the joint family and the rise of nuclear and extended family systems (Chadda and Deb 2013). Technology has been shown to be beneficial to older people and question is one has to access how the technology/technology enabled-services going to improve the quality of elderly people. This paper reviews the senior citizens usage towards and perception of modern digital technologies in an Indian context.

2 Technology Usage and Adoption

We are living in a fast changing technological period and modern technologies have become part of our everyday life. Smart modern devices connected to the internet, have changed the way we communicate, work and live our life. We use on a daily basis from computers, cell phones, tablets, laptops and entertainment systems to refrigerators and kitchen applications. As people age, technology and technology enabled services have a great potential to improve the quality of life. Technology adaptation is a great concern today. It is all around us and if we have not adapted to that may feel we are not in control of ourselves. Its significance has not been overlooked by the business world, which daily introduces hundreds of smart technology-enabled services to the public. Over the period technologies designed for a mass market are not adequately sensitive to the needs of older people. Sara J. Czaja and Joseph Sharit in their study on the aging of population said, "In general, today's elderly are healthier, more diverse and better educated than previous generations". So, the potential future of the technology is to help older people to improve physical and emotion well-being.

Many shortcomings are faced by senior citizens regarding usage of modern smart devices due to increased complexity in accessing information both in terms of functionality and interface design. The capabilities of older people are very diverse in their capabilities and ageing factor increases the learning curve to acquire new knowledge. As the Information Society is moving more towards digital, it is becoming clear that several already disadvantaged groups are being excluded. Literature review shows that not enough attention is paid to the interaction design that would actually accommodate individual needs and preferences of elderly users in an Indian context.

3 Research Methodology

Demographic and technology prior-experience questionnaires were conducted with a selective sample of respondents over 60 years of age using smart phone (android) and living in Bengaluru. A survey was conducted with structured questionnaires followed by a semi-structured interview. The data collection technique used is self-administered questionnaires where participants were presented with the questionnaires in persons. The aim and objective of the study was explained and the participant was allowed to complete set of questionnaires after which the semi-structured interview was conducted. The intension of semi-structured interview was to know more about the role of technology in their life, aspiration and expectation from the modern technology and technology-enabled services. The number of participants was 25 and the language used was English. All participants were approached in their residence with prior appointment and the study was carried out individually face to face. In total 25 participants were selected for the study and all were healthy aged 60–75 years old. The majority of the participants were lived with their spouse and some alone with broad span of socioeconomic status.

We have chosen Bengaluru city for our research study because of its multi-cultural nature and home to large number of people migrated from other Indian states because of better standard of living, climatic condition, well infrastructure and better employability. Current population of Bengaluru is estimated to 10 million and by 2031 the population is projected 20.3 million (Bangalore Metropolitan Region Development Authority 2017). Average literacy rate of Bengaluru is 87.67% (Census 2011). The city is ranked number three in terms of most populous city in India after Mumbai and Delhi and has modern face of developed economy. It has emerged as the IT capital of India which attracted people from across India and abroad. In Bengaluru, numbers of senior citizens are ever increasing due to increasing nuclear families with few children in the society and other social conditions and this is going continue as population ages. There is a growing challenge in terms of elderly care and assisted living.

Inclusion criteria to identify the subjects for research study was senior citizens aged 60 above, using smart phone (android) and living in Bengaluru City. Exclusion criteria used for this research study are below 60 years old, non-android phone users and rural population. The reason for these criteria is to review the current Senior citizens usage towards and perception of modern technology.

4 Result

A total of 25 participants were involved in this study. During the study, it was observed that 92% of the participants were male and 8% of the participants were female. 48% of the participants were graduates, 24% of the participants were post-graduates, 12% of the participants were diploma holders, 12% of the participants were completed pre-university college (PUC) and 4% of the participants were completed high school as shown in the Table 1.

Table 1. Participant information.

Qualifications	Senior citizens
Graduates	48%
Post-graduate	24%
Diploma	12%
Pre-university college	12%
High school	4%

The results of the study and discussion are centered on frequency of technology usage, android phone usage, commonly used android phone apps, awareness and familiarity with commonly used control buttons of android phone, awareness and familiarity with commonly used control buttons of Microsoft Office applications, awareness and familiarity with commonly used control buttons of internet browser, awareness and familiarity with commonly used control buttons of digital camera and awareness and familiarity with commonly used control buttons of home entertainment system.

4.1 Frequency of Technology Usage

To investigate frequency of technology usage among senior citizens, we have looked into the digital products and services that are matching the interests and functional needs of the senior citizens. We have chosen 8 products for this study and the percentage of frequency of the technology usage by senior citizens given in the Table 2.

Table 2. Percentage of frequency of technology usage by senior citizens.

Digital products/applications	Use it everyday	Use it few times a week	Use it once a month	Used in the past	Never used
Android phone	100%	0%	0%	0%	0%
Google search	72%	8%	0%	0%	20%
Internet browser	56%	12%	4%	8%	20%
YouTube	48%	16%	12%	4%	20%
Windows application	44%	16%	0%	12%	28%
Digital camera	40%	0%	12%	24%	24%
Printer	32%	12%	16%	8%	32%
Tablet	28%	4%	0%	4%	64%

The study shows that the senior citizens are actively engaged with digital products and services. The Table 2 shows that 100% use android phone, 72% use google search, 56% use internet browser, 48% use YouTube, 44% use Windows applications, 40% use digital camera, 32% use printer and 28% use tablet on every day basis. Here, the most used are android phone, google search, internet browser and You Tube which are very much internet dependent. The tablet is the product least used by the senior citizens. Significant usage of internet-based technologies reveals that these technologies support their daily activities.

A significant percentage of participants used these digital products in the past due to their professional experience which is directly linked with their education. The overall percentage of frequency of usage goes from android phone to tablet as listed in the Table 2, where applications like Google Search, Internet Browser, You Tube, and Windows Applications are part of the android phone. This explains the relative advantage of internet-based activities in achieving their overall goals and diverse interactive applications to assist them.

4.2 Android Phone Usage

Mobile phone is no longer just a communication tool rather it has become a personal computer with advanced features and they have become virtual assistances. In this context we have carried out the study to investigate the android usage among senior citizens by selecting 9 apps which are relevant to the study (see Fig. 2). The chart shows that 100% use for making phone calls, 100% for sending and reading SMS (short message service), 80% for checking time, 76% for calculating, 68% for setting alarm, 64% for reading and sending emails, 64% for social media, 48% for surfing internet and 36% for making video calls.

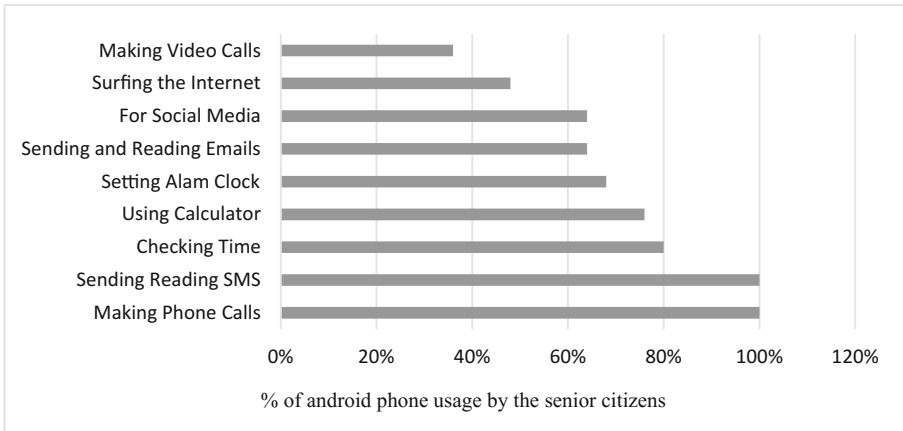


Fig. 2. Percentage of android phone usage by the senior citizens.

The above figure implies three categories of android phone usage by the senior citizens. Firstly, the phone is used for basic mobile services to allow users to make calls and send text messages. Secondly, the phone is used as clock and calculator. The participants feel that the mobile provides functionality to set alarms, add timers and keep track of time around the world using world clock. The calculator app provides simple and advanced mathematical function and they feel that it really helps them to do daily tasks. Thirdly, the phone is used for email, social media, internet surfing and for making video calls. Many senior citizens perceive additional usefulness of new technologies in comparison to traditional communication mediums. The Table 3 gives detailed information about commonly used apps by the senior citizens.

Table 3. Percentage commonly used mobile apps by senior citizens.

Commonly used apps	% of usage
Phone	100%
Contact	96%
Messaging	92%
WhatsApp	84%
Camera	84%
Calculator	84%
Email	84%
Calendar	72%
Google	64%
Maps	60%
Music	60%
YouTube	60%
Flashlight	48%
Skype	40%
Weather	36%
Sound recording	32%
Radio FM	28%
FlipKart	24%
Twitter	24%
Play games	20%
Voice search	20%
Play music	20%
Do it later	20%
Hangouts	8%
Drive	8%
Amazon kindle	8%
Health manager	8%
Health tracker	8%
Newsstand	4%
BP watch	4%
iCare	4%

The Table 3 clearly illustrates how each and every app is been used by the senior citizens to fulfill their needs for information, communication and entertainment. It is also self-evident that these apps assist them in daily life situations. The senior citizens reported that they use wide variety of applications and also it indicates that they are very much engaged larger part of social network and in one device they are able to fulfill many of their needs. Due to the demand and availability of the developer tools made rapid expansion into every single requirement. The usage of mobile apps is remarkably increasing among senior citizens.

4.3 Awareness and Familiarity with Commonly Used Control Icons of Android Phone

Navigation is an important aspect of any device/application to meet the goal and the control icons of mobile are guiding principles to create interaction system that naturally align with the user’s mental models. To investigate how well the senior citizens are aware and familiar with control icons of android phone, we have selected icons which are commonly used in phone as well as in most of the applications (see Fig. 3).

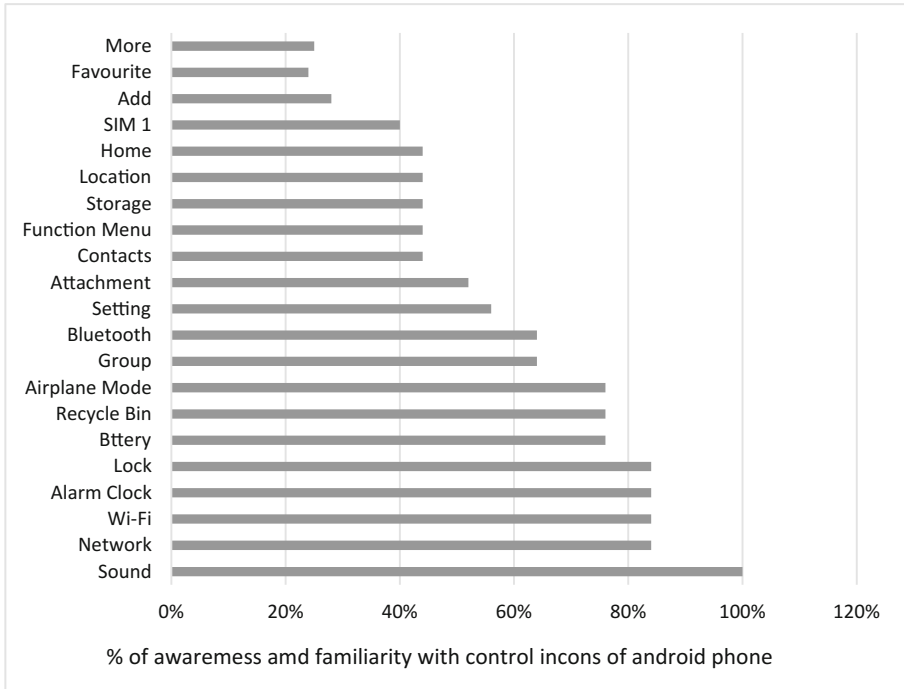


Fig. 3. Percentage of awareness and familiarity with commonly used control icons of android phone by the senior citizens.

The study shows awareness and familiarity of control icons by the senior citizens with 100% sound, 84% network, 84% Wi-Fi, 84% alarm clock, 84% lock, 76% battery, 76% recycle bin, 76% airplane mode, 64% group, 64% Bluetooth, 56% setting, 52% attachment, 44% contacts, 44% function menu, 44% storage, 44% location, 44% home, 44% SIM1, 28% add, 25% more and 24% favorite. The result tells that significant number of senior citizens are acquainted with the control icons mobile as well as various applications. This is very clear coming out when we look at the result of mobile usage and commonly used mobile apps in the Sect. 4.2. Moreover, it correlates with the kind of activities they perform to support their daily life.

4.4 Awareness and Familiarity with Commonly Used Control Icons of Microsoft Office Applications

Microsoft Office icons are essential communicative elements that clearly identify the action the user is taking when they use as a command. To investigate how well the senior citizens clearly identify meaning and function, we have selected commonly used Microsoft Office icons for the study (see Fig. 4). The result shows that 64% undo, 64% redo, 56% spell check, 52% search, 40% save and 40% new file control icons aware and familiar with selected control icons. The study indicates that the senior citizens have knowledge of working and managing Microsoft Office documents.

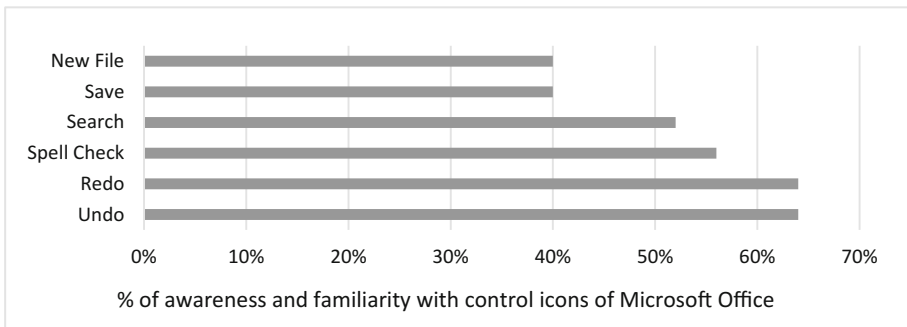


Fig. 4. Percentage of awareness and familiarity with commonly used control icons of Microsoft Office applications by the senior citizens.

All the senior citizens studied in this research study are retired persons and it proves that they were using Microsoft Office applications before retirement. They were all exposed to computing technologies in one way or another and this has brought confidence in them to use various applications in android phone.

4.5 Awareness and Familiarity with Commonly Used Control Icons of Web Browsers

The web browser control has several functions found among common web browsers to access and view websites. The internet and our lives have changed over the past few decades due to proliferating and multifaceted web information connecting every user worldwide regardless of time and space. Internet browsers are the gateway to access and we information and in this context it is essential to investigate awareness and familiarity with control icons of internet browser. We have selected commonly used control icons from Microsoft Internet Explorer, Mozilla Firefox and Google Chrome for the research study (see Fig. 5).

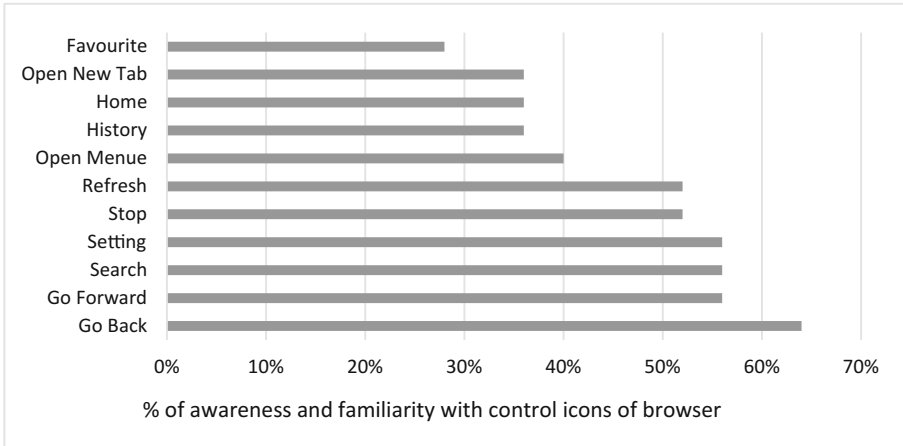


Fig. 5. Percentage of awareness and familiarity with commonly used control icons of web browsers.

The graph shows awareness and familiarity with commonly used control icons of internet browsers are 64% go back, 56% go forward, 56% search, 56% setting, 52% stop, 52% refresh, 40% open menu, 36% history, 36% home, 36% open new tab and 28% favourite. The study indicates a significant number of participants who use computer and android phone are familiar and aware of control icons of browsers. It also correlates with the activities of social networking and email applications. The participants said that the internet has created an opportunity to interact with family, friends and gain new knowledge from their home.

4.6 Awareness and Familiarity with Commonly Used Control Buttons of Digital Camera

Digital camera has become part of everyday life and its usage from taking selfies to family photos to documenting everyday life. Also it has lots of other uses than just holiday snaps and has become most used device of this age. The value of digital camera has increased manifold after the inception of internet. People share their lives openly in social media platform. In this context, we have selected the commonly used digital camera buttons to understand their awareness and familiarity (see Fig. 6).

The study shows that the participants are aware and familiar 60% delete, 56% play, 56% zoom in, 56% zoom out, 52% flash, 40% video, 40% setting, 40% voice recording, 40% landscape, 40% auto, 28% power, 24% sports, 25% night portrait, 25% close up and 16% portrait buttons. This indicates that the senior citizens are exposed to digital camera and they are active in using the camera in different modes of setting to fulfill their needs.

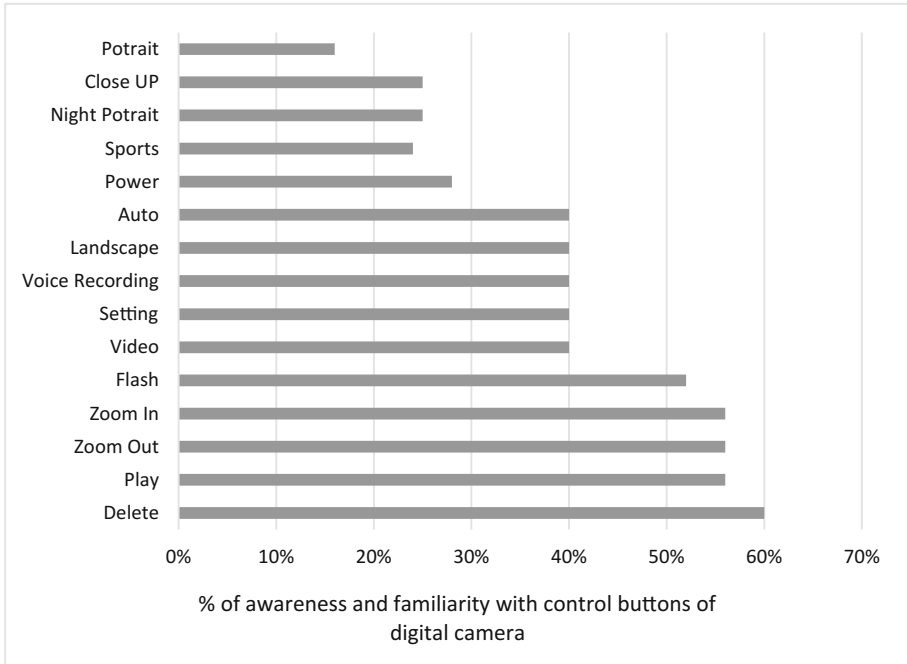


Fig. 6. Percentage of awareness and familiarity with commonly used control buttons of digital camera by the senior citizens.

4.7 Awareness and Familiarity with Commonly Used Control Buttons of Entertainment System

Today, the electronic industry is providing numerous products and services to the consumer. For senior citizens, it is big challenge to engage themselves during the day. Spending time with entertainment system like television and home theater music systems are very prominent today. To investigate the awareness and familiarity we have selected commonly used control buttons of entertainment system remote control (see Fig. 7).

The study shows that the senior citizens are aware and familiar with 100% volume, 100% channel, 88% mute, 76% play, 72% rewind, 68% power, 64% pause, 64% fast forward, 44% favourite, 44% return, 36% stop, 32% source and 32% open/close control buttons of entertainment system remote control.

This study indicates that the senior citizens are very much engaged with television during the day because television and music system make them cognitively engaged and assure companionship to them. The television provides not only entertainment programs but also knowledge, technology, science, sports, well-being etc. The television has become another family member with whom they can interact socially at any point of time.

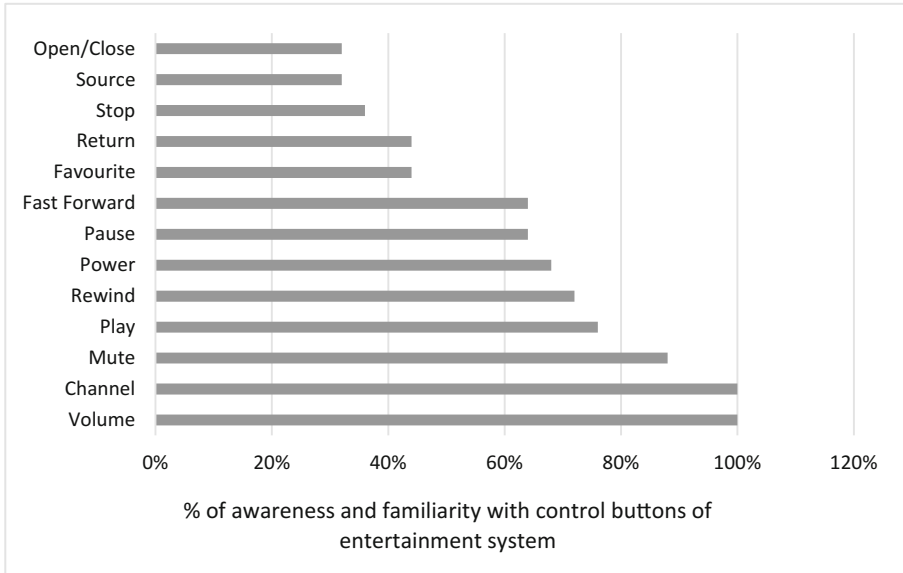


Fig. 7. Percentage of awareness and familiarity with commonly used control buttons of entertainment system remote control by the senior citizens.

5 Conclusion

Population ageing and growing number of elderly population is significant over decades. Smart technologies and services are proliferating. However the rate of adaption is very low due to various socioeconomic, physical and psychological factors. There is an increasing risk of excluding senior citizens with particular access needs. As the society is moving towards digital, the senior citizens do not want to exclude themselves rather they want to keep up with the current technological trend. They accept that they have to progress and learn to use technology and this becomes need of the hour. Smart technologies show great benefits among senior citizens and for successful acceptance their needs, perception, concerns, awareness and usage must be carefully evaluated. A survey was conducted with structured questionnaires followed by a semi-structured interview in Bengaluru city with a selected sample size of 25 senior citizens using smart phone technology.

All the participants said that technology is good and they are open to new technology. The reason given by elderly people for saying technology is good are “it improves life if used properly, helpful for day-to-day activities, to be part of change, when judiciously used, very good, younger use bad things, all the technology has brought us easy accessibility, learn lot of things, always good - should not have choice, enhance better quality of life, it helps so many new things every day, the world is going fast with technology and we can learn everything, improves your knowledge and takes you to the current technology, all feature is one service, to update present trend, good for new generation, it makes life easier and simpler, common man benefited by technology, it simplifies everything, it speeds up the process and when used properly”.

Senior citizens frequently use 100% android phone on a daily basis and the applications like google search and You Tube are also significantly used. This shows that they are able to perceive additional values other than the traditional communication. Senior citizens perceive the benefits of technology use and are actively engaged in terms of services it offers to them. The percentage of android phone usage illustrates that how categorically senior citizens engaged larger part of social network and in one device they are able to fulfill many of their needs. The percentage of awareness and familiarity with control icons of mobile, Microsoft Office, Internet browser, digital camera and entertainment systems are giving insight that the senior citizens are able to perform tasks in day-to-day life and fulfill their need. Although their fluency may differ from individual to individual.

Our analysis demonstrated that income, education level and social support appear to affect technology usage, perception and adoption. In general, we found that senior citizens use variety of modern technologies and technology-enabled services. We also noticed that the higher education levels directly related to overall perception, attitude and usage of technologies. The presence of family and friends also increases broader usage of modern technologies because of their assistance in teaching and learning. Senior citizens perceive the additional usefulness of modern technologies and they are not scared to use modern technologies.

The factors affect their usage and perception are user friendliness and accessibility issues. The factors enhance their usage are technology supported activities, suitability and contained useful applications. Understanding current usage and perception of modern technology in Indian context is complex but it is very essential to understand their concerns. The contemporary senior citizens are looking for value added services that can make their everyday life and tasks easier and provide added security.

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References

- Cerella, J.: Information processing rates in the elderly, *Psychol. Bull.* **98**(1), 67–83 (1985)
- Venkatesh, V., Morris, M.G., Davis, G.B., Davis, F.D.: User acceptance of information technology: toward a unified view. *MIS Q.* **27**(3), 425–478 (2003)
- Milne, S., Dickinson, A., Carmichael, A., Sloan, D., Eisma, R., Gregor, P.: Are guidelines enough? An introduction to designing web sites accessible to older people. *IBM Syst. J.* **44** (3), 557–571 (2005)
- Page, T.: Touchscreen mobile devices and older adults: a usability study. *Int. J. Hum. Factors Ergon.* **3**(1), 65–85 (2014)
- Chadda, R.K., Deb, K.S.: Indian family systems, collectivistic society and psychotherapy. *Indian J. Psychother.* **55**(6), 299–309 (2013)
- Pavel, M., Jimison, H., Hayes, T., Kaye, J.: Technology in support of successful aging. *Bridge-Linking Eng. Soc.* **39**(1), 5–12 (2009)

- Mitzner, T.L., Boron, J.B., Fausset, C.B., Adams, A.E., Charness, N., Czaja, S.J., Dijkstra, K., Fisk, A.D., Rogers, W.A., Sharit, J.: Older adults talk technology: technology usage and attitudes. *Comput. Hum. Behav.* **26**(6), 1710–1721 (2010)
- Fleck, R.: Rating reflection on experience: a case study of teachers and tutors reflection around images. *Interact. Comput.* **24**(6), 439–498 (2012)
- Elsevier, B.V.: Moving towards inclusive design guidelines for socially and ethically aware HCI. *Interact. Comput.* **17**(5), 485–505 (2005)
- Demiris, G., Rantz, M.J., Aud, M.A., Marek, K.D., Tyrer, H.W., Skubic, M., Hussam, A.A.: Older adults' attitudes towards and perceptions of 'smart home' technologies: a pilot study. *Med. Inform. Internet Med.* **29**(2), 87–94 (2009)
- Stray, C., Peschl, M.F.: Representation still matters: cognitive science and user interface design. *Behav. Inform. Technol.* **17**(6), 338–360 (1998)
- Peek, S.T.M., Wouters, E.J.M., van Hoof, J., Luijckx, K.G., Boeije, H.R., Vrijhoef, H.J.M.: Factors influencing acceptance of technology for aging in place: a systematic review. *Int. J. Med. Inform.* **83**, 235–248 (2014)
- Birren, J.E., Fisher, L.M.: Aging and speed of behaviour: possible consequences for psychological functioning. *Annu. Rev. Psychol.* **46**, 329–353 (1995)
- Czaja, S.J.: The impact of aging on access to technology. *Accessibility Comput.* **83**, 7–11 (2005)
- Plazaa, I., Martína, L., Martínb, S., Medranao, C.: Mobile applications in an aging society: status and trends. *J. Syst. Softw.* **84**, 1977–1988 (2011)
- Birren, J.E., Morrison, D.F.: Analysis of the WAIS subtests in relation to age and educational. *J. Gerontol.* **16**, 363–368 (1961)
- Barnarda, Y., Bradleyb, M.D., Hodgsona, F., Lloydc, A.D.: Learning to use new technologies by older adults: perceived difficulties, experimentation band usability. *Comput. Hum. Behav.* **29**, 1715–1724 (2013)
- Baltes, P.B., Lindenberger, U.: Emergence of a powerful connection between sensory and cognitive functions across the adult life span: a new window to the study of cognitive ageing. *Psychol. Ageing* **12**, 12–21 (1997)
- Arab, F., Malik, Y., Abdulrazak, B.: Evaluation of phon age: an adapted smartphone interface for elderly people. *Interact* **2013**, 547–554 (2013)
- Hofer, S.M., Alwin, D.F.: *Handbook of Cognitive Aging: Interdisciplinary Perspectives*. Sage Publications, California (2008)
- Subaiya, L., Dhananjay, W.: *Demographics of Population Ageing in India*. Institute for Social and Economic Change, Bangalore, United Nations Population Fund, New Delhi, Institute of Economic Growth, Delhi (2011)
- O'Brien, M.A., Olson, K.E., Charness, N., Czaja, S.J., Fisk, A.D., Rogers, W.A., Sharit, J.: Understanding technology usage in older adults. In: *Proceedings of the 6th International Society for Gerontechnology*, Italy (2008)
- Culén, A.L., Bratteteig, T.: Touch-screens and elderly users: a perfect match? In: *ACHI 2013 The Sixth International Conference on Advances in Computer-Human Interactions*, France (2013)
- Chernbumroong, S., Atkins, A.S., Yu, H.: Perception of smart home technologies to assist elderly people. In: *The 4th International Conference on Software, Knowledge, Information Management and Applications (SKIMA 2010)*, Bhutan (2010)
- Borah, H., Shukla, P., Jain, K., Kumar, S.P., Prakash, S., Gajrana, K.R.: *Elderly in India*. Ministry of Statistics & Programme Implementation, Government of India, New Delhi (2011)
- Department of Economic and Social Affairs, *World Population Prospects*. United Nations, New York (2015a)
- Department of Economic and Social Affairs, *World Population Ageing*. United Nations, New York (2015b)

- Bangalore Metropolitan Region Authority, Bangalore Metropolitan Region Revised Structure Plan-2031, Bengaluru (2017)
- UN World Population Prospects 2017. [https://esa.un.org/unpd/wpp/Graphs/Demographic Profiles](https://esa.un.org/unpd/wpp/Graphs/Demographic%20Profiles). Accessed 15 Jan 2018
- Infogram. <https://infogram.com/percentage-distribution-of-population-by-broad-age-groups-1g0gmjw34yj8p1q>. Accessed 30 Jan 2018
- Population Reference Bureau. <http://www.prb.org/Publications/Reports/2012/india-older-population.aspx>. Accessed 30 Jan 2018
- Population Census 2011. <https://www.census2011.co.in>. Accessed 30 Jan 2018