Developing Advanced Appliances Control System in Toilet and Bathroom for Aged Generation: FGD Preliminary Findings

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***Abstract* - When a person gets old, there are many changes that occur in the aspect of biomechanical features such as bones, joints and muscles which can affect their mobility and strength including reduction in vision and hearing abilities. Thus, this condition will expose them to risk of injuries and accidents. Based on previous studies, toilet and bathroom are identified as the common place where injuries and accidents occur involving older persons. Therefore, in order to create safe and suitable environment for older persons, modifications to products, systems and environments for their daily use should be taken into consideration. Environmental modifications and assistive technology (AT) can compensate for limitations in functional capabilities and thus promoting the well-being and independence of the elderly. In this study, the initial approach is through qualitative methods which was Focus Group Discussion (FGD). Information related to issues and problems, causing factors and suggestions for improvement will be used as an important indicator in the development of relevant systems in this study.**

***Keywords* - older Malaysians, FGD, assistive technology, bathroom, toilet**

I. INTRODUCTION

The elderly population in Malaysia is growing rapidly. According to Department of Statistic Malaysia 2018 census indicated that from the total population of 32.38 million, about 3.23 million (9.97%) consist older persons age 60 years and above, where life expectancy at birth for men and women are 72.7 years and 77.4 years respectively. By 2034, the number of seniors is expected to increase to over 5.1 million, making up 15 percent of total population, where Malaysia is expects to reach aged nation status during that time (Chai & Hamid, 2015). This increasing rate is postulated to be due to socio-economic development and public health policy where fertility rates decline and longevity rates increases.

Despite the increasing number of older persons, it also provide issues and challenges to the nation development in the aspect of health, socio-economic as well as the environment. This is because the environment is an important factor in self independence for older person (Illario et al., 2016). Therefore, there is the need to create the right environment for older persons. The right environment in this context is when older persons fit with their environments and feel most comfortable there, where this is called as person-environment fit as introduced by Lawton and Nahemow (1973). Older people often spend more time at home (Baltes et al., 1999; Krantz-Kent and Steward, 2016). However, with increased age, mental and physical ability will begin to decline. This is because changes in joints and muscles reduce their mobility and strength. Skills that require significant strength, movement, and sensory control for many tasks are clearly reduced. Old age also causes a reduction in vision and hearing abilities. This situation can indirectly expose them to the risk of falls including injuries and accidents. According to Yeong, Tan & Yap, (2016), one in every twenty five older Malaysians living in community setting, living alone and being indigenous experienced falls. In addition, as reported by several researchers, most of the injuries including falls among older persons are in toilet or bathroom (Lim et al., 2013; Joshi & Dsouza, 2015; Rosen, 2013). Therefore, toilet and bathroom need to be designed well to promote familiarity for older persons.

With today's advances technological innovation, networking and sensing, it is seen possibility to be adapted to assist older persons in bathrooms and toilets through the use of certain mechanisms and controls such as lifting users up and down without support while standing or sitting (Magnusson et al., 2011), different sensor, automatic door locking system, robotic arm for cleaning toilet (Katariya et al., 2018), flexibility for fixtures, sensing technologies to measure biomechanical data, vision system and smart floor sensors for tracking movement and gait (Sanford and Jones, 2014). This smart technologies may help to enhance quality of life,

prolong independent living and reduce caregivers' necessary time and healthcare costs in general, without losing the safety that a continuous and unobtrusive monitoring provides. Thus the benefits of these technologies are not only for the older adults, but also their families, caregivers and society in general (Q. Ni, Hernando and de la Cruz, 2015).

Thus, this study intends to develop advanced toilet and bathroom control system by exploring issues and challenges faced by older persons in their home especially in the toilet and bathroom as well as identification of way of solutions and consideration that need to be taken via the Focus Group Discussion (FGD).

II. METHODOLOGY

Focus Groups Discussion (FGD) is frequently utilized as a qualitative approach to gain an in-depth understanding and obtain data of certain issues from a purposely selected group of individuals rather than from a statistically representative sample of a broader population (Nyumba, et al., 2017). In this study, FGD was used to gain information about developing smart bathroom and toilet for older Malaysian. The participants were divided into several groups consist of 3-10 participants for each group. Then, participants were given written information about the purpose of the study and they signed an informed consent form to ensured confidentiality of participation. This study also has received ethical approval from the research Ethics Committee of Universiti Putra Malaysia. All FGDs were conducted by trained Moderators and assisted by Rapporteur (note-taker). Moderator starts a discussion session by welcoming participants and explained the purpose of the study. Then, participants were invited to introduce themselves and given the opportunity to ask whether they have any questions or inquiries regarding to this study.

Participants/respondents were asked questions related to the topic of study. The moderator guided the discussion and encouraged all participants to share and ensured giving sufficient time for each participant to express his or her own view. Each session was recorded using digital voice recorder and notes taken which was later reviewed and analyzed. The focus groups lasted from one and half hour to two hours. Analysis of this FGD data is based on analysis of discussion content either from notes taken or digital voice recorder and being transcribed in text form. Then, data was structured systematically and categorized into a particular classification based on issues and challenges, way to solve issues and challenges and important criteria's for consideration in designing advanced bathroom and toilet appliances control system for older Malaysians.

III. RESULTS AND DISCUSSIONS

A total of 10 participants were recruited in this discussion involving older persons age 60 years and above, carer/family members and agencies/authorities related to housing planning/development and technologies.

Issues and challenges in bathroom and toilet

Based on discussion, there were some issues and challenges faced by senior citizens regarding to bathrooms and toilets use. Hence, researchers have identified and categorized them into three issues, which were hazards, ergonomics and design.

i. Hazard

For hazards, respondents reported that bathtub base, bathroom floor and wall were slippery, toilet floor was always wet and risk of head being knocked during laundry under the sink. Related to literature the prevalence of bathroom hazards among elderly was high (Joshi & Dsouza, 2015) and bathroom/restroom was the most dangerous area for those who have experienced falling (Neslihan & Belgin, 2013). The statements below were some of the information shared by the respondent during the discussion.

Elderly (F): The tile was slippery. There was no non-slippery

Agency Executive (M): So, nowadays even though the tiles is rough type but if there have water on it, it's still slippery

Elderly (F): Sometimes the walls are slippery too.

Elderly (F): Activities of defecation, urination and bathing will all cause wet floors

Elderly (M): Our people like to use a lot of soap. This makes the floor slippery.

Elderly (M): When washing under the sink, sometimes when stand up, the head will knocked

ii. Ergonomics

Accroding to Sinan (2018), ergonomics is specifically defined as methods that employ anthropometry, body mechanics, labor physiology, labor psychology and many other disciplines, using human-machine-environment system as the basic research subject, to study the structural and functional characteristics of human body, and to provide characteristic parameters of physical structure, for example the size, weight, body surface area, proportion, gravity center of various parts of human body, as well as the relationship and the approaching range of body parts in activity.

Toilet seat was too low, knee pain when standing up from lower seat toilet, difficulty to rise up while using squat toilet and body posture was bends while opening the water pipe were several ergonomics issues identified by respondents in this discussion. Refering to toilet transfers, lower toilet seats height creates a problem for many older adults, especially those with arthritis and/or hip, knee, or back problems (Stefanacci & Haimowitz, 2014). Thus, there is a preference for vertical supports for sitting down and standing up as well as side supports during toilet use (Dekker et al., 2006)

Agency Executive (M): Sitting more easier for senior citizens, squatting is difficult.

Elderly (F): if you got very low and we want to wake up, of course we have a problem with our knee.

Elderly (F): It's all the toilet squats. I can't stand up if i've seated

Elderly (F): For me currently i have to bends slightly while opening the water pipe, but it's not too high or too low

iii. Design

Some issues related to design mentioned by respondents in this discussion were no grab bar to hold during entering bathtub, no safety railing, bathroom was too big and far from bedroom (kampong house). This was similar to finding by Guitard et al. (2013) where most participants had no grab bars in their home. Moreover, in the absence of appropriate bath grab bars, seniors reported using potentially hazardous contacts to facilitate transfers while bathing (Sveistrup et al., 2006) as will become environmental risks for fall among elderly (Patil et al., 2015). The view expressed by the respondents regarding the design as mentioned below:

Elderly (M): Quite big. There is space available

Elderly (F): I thought to install railing like in MRT.

Elderly (F): Like kampung house, sometimes bathroom is distance from the bedroom.

Way to solve issues/challenges in bathroom and toilet

Based on the issues and challenges that have been shared by these respondents, they also have provided some suggestions to address issues and challenges such as bathroom near to the bedroom, installed handrail, anti-slip towel, use toilet chair for bowel and etc. Hence, researchers have categorized its into two aspects, which were home modification and assistive aids/devices. Home modification is any change made to a home or residence to meet the needs of an individual who has physical limitations so that they can live independently and safely. Most homes are not designed to accommodate individuals as their age. There are structural barriers that can affect them to do their daily routine without assistance. Many homes older adults were built in a time when physical accessibility for either the elderly or people with disabilities was not a consideration. While assistive aids/devices means in Technology-Related Assistance for Individuals with Disabilities Act of 1988 was any item, piece of equipment, or product system, whether acquired commercially, modified, or customized, that is used to increase, maintain, or improve functional capabilities of individuals with disabilities. The statement given by the respondent were mentioned below.

Elderly (F): Maybe for the roilet, you can make a two-way lock. For safety, people outside also can open.

Elderly (F): Normally they will recommend for elderly the sliding one.

Elderly (F): if it can be the light that we can remotely control. If need to press the suiz. If we have remote control, it is good.

Elderlry (F): We use that (lever), for whatever reason he/she can hold it.

Elderly (F): It's slippery. There is no non-slippery tile. That's why I put the plastic mat on it.

Elderly (F): For me, the bathroom must be close to the bedroom. Easy to use it.

Elderly (F): But if we wants to avoid wet floor, I recommended to install covered screen. So during bathing, the water will not spill out to the other side. However, that's only suitable if we have a big bathroom.

Elderly (F): can place anti slip towel in the bathroom

Elderly (F): Another issue is sink design. It's should follow the customer needs. It can go up and down. Adjustable. This is new technology.

Elderly (F): Another necessity was a heater in the bathroom. I saw many old people don't like cold water.

Based on previous study, there was a positive relationship between home modifications and aging-in-place, where seniors who have modified their housing are likely to have stayed longer in their current housing (Hwang et al., 2011). In the context of asistive aids/tools, some studies reported that bath aids may lead to reductions in self-reported difficulty in bathing (Verbrugge, Rennert & Madans, 1997) and the hours of required personal assistance for bathing (Agree & Freedman, 2000). Some studies stated that the use of grab bars for the toilet and bathtub is known to be effective in reducing the risk of falls for both ambulatory people and mobility device users (Aminzadeh et al., 2000; Toro et al., 2013; Tzeng and Yin, 2010 in Morales et al., 2017).

IV. CONCLUSION

Many older persons are living in potentially hazardous home environments especially in bathroom and toilet. Therefore, home modification and use of assistive tools are seen as a way of preventing or reduce risk of accidents and injuries among older persons in bathroom and toilet.

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