

# Assistive and wearable technology for elderly

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## ARTICLE INFO

## ABSTRACT

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The current technology is able to assist the daily activities of elderly without depend on others. That's because the physical condition of the elderly began to decreasing. The decreased physical conditions can include slow body movements, lack of balance of the body, decreased coordination of movement between limbs, memory loss, and decreased capacity to process information. With those many limitations possessed by elderly, they used technology to help them. There are two kind of technology that used to help elderly, those technology are wearable technology and assistive technology. This paper will discussed about some wearable technology and assistive technology that can help the problems experienced by elderly.

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## 1. Introduction

Elderly is the final adult period beginning in the 60s to the 120s, that having the longest lifespan in the period of development [1]. Elderly is the phase of decreasing intellect, physical, and psychological ability. The decreased physical condition may include slow body movements, lack of balance of body, decreased coordination of movement between the limbs, decreased memory, and decreased capacity to process information [2]. Those limitations make elderly difficulty to do their activity and they start depend on others. Limitations possessed by the elderly can be overcome with the help of technology.

Technology nowadays are able to improve the quality life of the elderly to be even better in performing daily activities without rely on others. But the technology that exists today may not use maximally by the elderly. This is because there's a technology gap experienced by the elderly. Generally, elderly do not feel that the technology include computer and internet means to them [3]. This causes the elderly never want to know about any kind of possible benefits from technology. Finally they only focus on the negative side of the technology. They assume that technology is only for young people [4]. This explains that the utilization of technology by the elderly is very low and uneven.

It is unfortunate that elderly are reluctant to use technology that can obviously help them in their daily activities. To introduce about various aspects of gesture intimacy, language familiarity, functionality and ease of use from technology, it's necessary to increase the elderly's desire to know about technology [5]. In addition, it is also necessary to approach and counseling the elderly about technology. With this kind of approach and counseling the elderly will be familiar with technology that can assist them in doing their activities easier. Technology that can be utilized by the elderly are assistive and wearable technology.

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## 2. Elderly and Technology

Elderly is a period where humans will experience aging which is the last phase in life that begins when entering the age of 60 years and above. The aging process is also subjective, individuals who's in the same age may have different physical and mental abilities, which may or may not be related to how long they last [1]. Over time the elderly will have functional impairment that caused them difficulties on doing their daily activity. Naturally, the decreasing functional that occurred to elderly is a decrease in sensory acuity (touch, taste, odor, sight, hearing and temperature); decreased mobility, stamina, and muscle strength; changing stability; as well as changing mental clarity [6].

According to the World Health Organization (WHO), in 2025 there will be about 1.2 billion people in the world aged over 60 years or often called elderly [7]. The increasing number of elderly population resulted in the number of elderly who live alone at home. If elderly live alone and no one is watching them, the risk of their critical condition will increase [8]. This is very worrying. Because of these concerns, currently there are a lot of technology that created specifically to monitor the condition of the elderly.

Technology helps the elderly to stay in touch with their family and friends, helping to ensure home security, and facilitate them in health care [9]. This brings new stimuli into the elderly life and provides more access to information through the internet. Elderly will use internet to get the health information. They feel comfortable using the internet to find health information. They will use internet to find information that has a direct impact on the type and quality care that they get [10].

It is not easy to introduce technology to the elderly. There are many things that must be urged to elderly that want to use technology. According to Fisk et al (2004), they have identified five very important characteristics when introducing technology and its usefulness to elderly [11]:

- Learnability, how difficult it is to learn to use the tools, understand and integrate functioning instructions. They need time to complete the task correctly and the results obtained in a certain amount of time is a possible measure of learning.
- Efficiency, which technology applications meet user needs, avoid loss of time, frustration and dissatisfaction. This can be measured by the performance of experienced users on a particular task.
- Memorability, elderly alerts to device functionality are essential to avoid frustration and loss of time. A simple measure of these characteristics can be obtained by take into time counting that required to perform the tasks that previously experienced.
- Error, how easily a product can cause errors for elderly users and how easy it is to recover from it.
- Satisfaction, user attitudes and application of technology applications can be affected by the fun derived from their use.

Most of the technology for the elderly is currently focused on achieving a platform that can monitor medical records of health status in real-time, improve the concept of online diagnosis, improve security and integrity, develop and improve telemedicine that handles the delivery of long distance telecommunication services using telecommunications [12]. Some advantages of using technology / systems that can be used to measure mobility are direct access to biomechanical parameters, data retrieval and processing can be done anywhere [8]. There are several types of technology that can be used directly by the elderly. Those technology are assistive technology and wearable technology.

## 3. Assistive Technology for Elderly

Assistive Technology may be defined as a commercially acquired tool or product which is modified or adjusted to enhance, maintain, or improve the functional capability of individuals with disabilities [13]. From the description above it can be concluded that assistive technology is a technology that includes tools and solutions that can help the functional limitations that experienced by individuals [14]. But actually not only disabled people who need assistive technology, elderly also need assistive technology to help their daily activities.

Assistive Technology is able to make daily activities of the elderly become easier [15]. Assistive technology itself is also considered able to help three kinds of criteria, namely Assistive Technology for Everyday Activities, Assistive Technology for Safety, and Assistive Technology for Social Participation.

First, there are assistive technologies that can help the elderly everyday activities, such as Digital Pillbox or digital medicine box is a medicine box that equipped with a system that allows users to take the medicine on time and correctly [16]. This system is equipped with a sensor that will record users while they are taking the medicine, also a real-time feedback that notes user that taken and drank the medicine. This system also has the utility to increase user awareness, identify errors quickly, and confirm memory to help improve their self-efficacy, maintain their performance, and preserve their autonomy without resorting to disturbing reminders. The next technology is an appointment reminder, is an assistive technology product that is made to help the elderly everyday activity suffering from dementia disease [17]. With the assistive technology is expected, people with dementia disease can be helpful in remembering something that had been planned before.

Second, there are assistive technologies that can be used as an elderly security system. For example the lighting path, the function of the Lighting Path is to reduce the risk of falling elderly when doing activities at night [18]. For example, they will wake up in the middle of the night to go to the toilet. So it was made a nightlighting system to provide ambient light and visual veridical cues. With this assistive technology, the risk of falling elderly when doing activities at night will be reduced. The second one is a Home Monitoring Technology. One example of assistive technology that can help the elderly is Home Monitoring Technology. Home Monitoring Technology itself is a smart-home technology that consists of a set of technology that serves to help in securing the home [19]. These technologies will be installed in all parts of the house such as bedroom, bathroom, kitchen, family room, and yard. There are several advantages in implementing Home Monitoring Technology such as, easy to use and does not require extra care, it does not cost a lot of money to use it, ensure home security, and be able to detect and give appropriate warning during emergency situations. The next technology is a Smoke Detector, This tool reacts to a visible and invisible fire aerosol, and therefore it can detect the presence of fire using an optional ionization detector. And the last one is a Door Alert, Door alert is a sensor that attaches to the door, this tool is useful for people who like to roam at night. This tool will work by making video calls to relatives while people are hanging around.

Finally, there are assistive technologies that can be used as an elderly social participation. For example, Video Telephone with the function of this assistive technology is to help the elderly in communicating with others. It is expected to help elderly who are unable to interact directly due to various factors. These factors can be the distance or even the type of illness suffered by the elderly so that the elderly will not feel isolated. Video Telephone can also be used as a tool to monitored elderly well. The next technology is a Digital Pictures, In general, the function of digital pictures with video telephone. It's just for digital pictures elderly can not receive a feedback in real-time.

Elderly need technology because they have decreased cognitive abilities and physical abilities that require them to reduce their daily activities [20]. But not all elderly can receive assistive technology, it is due to several factors that affect the elderly. These factors are characteristic of elderly, social environment, and also the ability of technology access owned by theirselves [21]. So it takes another type of technology that can be easily used by the elderly, such as wearable technology.

#### **4. Wearable Technology**

The growth of mobile computing technology is currently delivering huge changes in the last few decades, the next trend in computing technology is moving on smaller objects of mobile and is called wearable computing [22]. Wearable computing or can be called wearable technology was created to integrate everyday life and simplify human work in the form of small and easy to use [23]. Especially with the development of head-mounted displays (HMDs), wearable has become a ubiquitous and user-friendly technology [24].

Wearable Technology (WT) is a computing technology device that can be used on the human body, whether the computer is incorporated as an accessory or as part of the material used in clothing [25]. WT devices are present in various forms such as watches, glasses, bracelets or even jewelry. WT offers new opportunities to monitor continuous elderly activity with miniature wearable sensors. It

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increases the efficiency, productivity, service and involvement of families and health authorities. This WT tool mostly aims to change the elderly's health behavior so that they are more motivated to pay attention to their health [26]. Some WTs created specifically to help the elderly include:

Lively wearable ([www.mylively.com](http://www.mylively.com)), Lively wearable is a technology that provides convenience for the elderly by using lively wearable. Elderly get a reminder feature hours of medicine and emergency calls in case of dangerous conditions. Simply press a button, the user will directly connect with the emergency service center number. This wearable uses long-lasting batteries that are not refilled, so it is safe for the elderly whose memory starts to decline [27].

Elderly Care ([www.geeny.io](http://www.geeny.io)), Elderly Care from Geeny provides several technology products that provide convenience for the elderly. Several products such as smart power sockets that serve to provide a warning of danger will occur. The dangers that can occur include elderly activities that like to cook but they forget that they are cooking so the stove turn on and can cause a fire. With smart power sockets it can be handled, ie by directly lowering the temperature of the stove. There is also a sensor that can be used by the elderly in case of emergency. Just by pressing the emergency button then the child will soon know that their parents are in danger condition, this is because of the sensor will be directly connected to the child gadget. For the health of the elderly Geeny also provides products under the name Smart Blood Pressure Meter which directly relates to children and doctors [28].

Pocketfinder GPS Trackers ([pocketfinder.com](http://pocketfinder.com)), Pocketfinder GPS Trackers is one of the technologies that can detect the location of elderly through smartphones. Pocketfinder can detect location up to 60 days. Therefore this tool is suitable given to the elderly because the child will be able to easily check where the location of their parents are [29].

Wearable Care System [30], Wearable Care System is designed to monitor some parameters such as heart rate, respiratory rate, body temperature, and the position of elderly. From the monitored parameters the results can be seen in applications that can be accessed with a PC. These tools form a sensor that attached to a garment, so that when elderly people will wear it feels like wearing ordinary clothes.

Wearable Skin-Stretch Device Combined with Haptic Joystick [31], this wearable technology is designed to facilitate the operation of the wheelchair that used by the elderly, so they do not have to rely on others to push it. This tool is very easy to operate. This tool is also able to provide a very good balance so as to minimize the occurrence of accidents.

Wearable Smart Home Technology Help Senior Age in Place, wearable has a function as smart home designed in the form of watches so elderly can use it easily. This tool is integrated with the phone to make arrangements. But when it used by elderly they just have to move their hands on one thing they want to control such as turning off or turning on the lights and locking the door.

Those examples of WT products can be used by elderly to assist their daily activities and monitor their health condition. Wearable Technology is a solution to solve the problem about increasing the burden on health care systems and rising current healthcare costs nowadays [32].

Based on the types of those technologies described earlier, they can be represented in a Table 1. From table 1, it is known that there are various technologies that can help the elderly, either from assistive technology or wearable technology. All those usefulness and function of the two kinds of technology is same. The difference between these two technologies are only in the implementation of the technology used. Assistive technology has a technology that has a large size and difficult to carry anywhere. While wearable technology has a relatively smaller size compared with assistive technology. With a smaller size, wearable technology can be used easily and can be taken anywhere.

**Table 1.** Comparison of Technology for Elderly

Technology Type	Name	Function
Assistive Technology	Digital Pillbox	As a reminder and recording system in taking medication for the elderly and assisting in confirming memory to help improve the elderly self-efficacy
	Appointment Reminder	Helps in reminding people with dementia in remembering something that has been planned before
	Lighting Path	Helps in arranging the lighting at night to minimize the occurrence of accident against the elderly at night
	Home Monitoring Technology	Helps secure the home with smart-home technologies that used in the home
	Smoke Detector	Helps in detecting a fire by using an optional ionization detector in the home
	Door Alert	Helps in detecting the presence of people who like to roam at night
	Video Telephone	Helping the elderly in communicating and interacting in real-time with others
	Digital Pictures	Helping the elderly in interacting but not real-time
Wearable Technology	Lively Wearable	Helping the elderly in remembering to take the medicine, and able to provide information when the elderly get lost that resembles a watch so it can be used anywhere and anytime
	Smart Power Socket	Warned the elderly when the are in danger, such as forgot to turn off the stove and iron. This tool is also directly connected with child smartphones so they will know when their parents are in danger
	Pocketfinder GPS Tracker	Helps to detect the position of the elderly with tools directly connected to the smartphone
	Wearable Care System	Helping the elderly in monitoring the pulse, breathing frequency, body temperature, current position
	Wearable Skin-Stretch Device Combined with Haptick Joystick	Helping the elderly by providing ease in operating the wheelchair without relying on others and providing a balance that minimizes the occurrence of accidents
	Wearable Smart Home Technology Help Senior Age in Place	Helping the elderly in taking care of their homes

## 5. Conclusion

Wearable technology is considered easier when compared with assistive technology. For example, comparable pillbox digital products from assistive technology with lively wearable from wearable technology. Both products are products with the same utility, which is reminiscent of the elderly in taking the medicine. But in its implementation, lively wearable can be more easily used by elderly. Because lively wearable shaped like a watch that has a smaller size and can be brought anywhere either for activities in the house or outdoors. In contrast to lively wearable, digital pillbox has a larger size and can not be taken anywhere with ease. So for elderly who have activities outside the home can not use the tool.

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