Integrated Healthcare Services for Ageing in Place

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ABSTRACT: This study investigates how healthcare practitioners handle significant circumstances of providing medical assistance and treatments to patients and what challenges they face. Drawing on key healthcare stakeholders and mixed smart living methods, we develop a guideline service protocol for an Internet of Things (IoT) solution to help healthcare stakeholders cope with operational difficulties. IoT technology is one of the key determinants that empowers healthcare professionals to achieve their tasks, and our goal is to study the functions that provides to local citizens, especially older people, and to evaluate how the functions and platform could assist corporate compliance policies to increase the efficiency of healthcare service. Our field experiments have indicated a need to educate healthcare users about IoT applications that provide advantages in decision making. In addition, our research has explored and evaluated the impacts and factors that influence the development and collaboration by allowing workflows of healthcare stakeholders and by following integrated smart living platform ideas and their required service protocols.

Keywords: Internet of Things, Ageing in place, Older Adults, Healthcare service, Smart City

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1. INTRODUCTION

The growing popularity of using technologies for quality-of-life improvement enables older adults to be independent and maintain their well-being when living at home or living independently with others, which requires good social care services. Healthcare technology deployments are intended to improve quality of life and well-being (Alwan 2009; Wilson et al., 2009). Since local healthcare service providers face challenges and need to develop efficient services owing to a greater demand for healthcare and well-being services, there is a consequential inability to respond to the needs of older adults in terms of acquiring technological tools. Thus, older adults have not been using many selected assistance devices (Martin et al. 2008; Frisardi and Imbimbo 2011). However, technology adoption and development-based equipment have been defined as practical and useful tools that can contribute to improved quality of life and well-being (Thielke et al., 2012). Technology product acceptance among older adults is fostered by developing integrated services to support and provide convenience as well as reduce perceived risks. Older people prefer to increase their physical activity, be independent, and have access to immediate assistance (Farivar et al., 2020). Key stakeholders in health care systems, such as technology designers and operational workers, need to respond to the need to acquire ex-

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cellent health care services by using newly adopted technologies. However, less attention has been paid to providing individuals, such as workers, with support in adopting these technologies, which demotivates them from offering the technology assistance for people such as older adults. This lack of support increases the perception of unfamiliarity and complexity when it takes in place in relation to the tools offering the best solutions. It also influences health care service receivers regarding new solution acceptance via adopted technology equipment and platforms, since older adults seem to follow professional instructions (Peek et al., 2014).

Internet of things (IoT) embodies significant technology that is embedded with sensors, software, and other technologies for the purpose of connecting, exchanging, and analysing data with devices and systems. Thus, internet of things (IoT) platforms are used to develop many service platforms such as fleet management, connected enterprises, industrial automation, and smart healthcare Internet of things (IoT) platforms because they can improve efficiency and minimize the human effort required to provide service. In efficiency healthcare, the IoT technology is used to connect healthcare devices and sensors to develop more efficient service systems to meet the growing demand.

The process of implementing and building the required services is aimed at helping older adults to use convenient equipment as daily assistants to live safely and securely when they are at home and to maintain their well-being, such as by exercising without worrying about unknown dangers or unforeseen incidents. These services could reduce health risks (Fuchs and Reichel, 2011). Despite the promised benefits of using assistive tools, such as a service platform in the health care system based on the standard Internet of things (IoT) platform, to satisfy the needs of the users, it must provide broad benefits and respond to individual needs. It is also necessary to design simple technology products, which should be described as user-friendly equipment. In other words, health care practitioners should agree on the functions and benefits of using technologies to support themselves, such as increasing their efficiency to respond to health care needs through health care-related individual behaviours. Devices must have a simple design and risk-free use (Mostakim Fattah et al., 2017). There is an ever-larger ageing population globally and regionally, which means there is an increasing need for individual social and healthcare services, including integrated healthcare services for older people. Implementing integrated social healthcare is at the core of maintaining quality of life (Harnett et al., 2020). Additionally, older adults face health problems such as multiple illnesses, and this demographic has proven to be one of the key challenges for local governments and authorities in developing integrated social and healthcare services with efficiency and equality in every place required. Authorities must implement a senior segmentation of health care support as a regular discipline among health care professionals (Arun and Holdsworth, 2020).

Therefore, attention must be given to inequalities due to class, gender, and poverty among people receiving integrated healthcare services. It is important for authorities and policy makers to be concerned with the efficiency of central governments that are transferring responsibilities to local governments with the aim of responding to the practical individual needs of the ageing population. There is great concern about improving the efficiency of technological adoption in integrated social and healthcare service platforms. Prior studies have provided few evaluations when implementing technological products, and often do not indicate whether they enable professionals and workers in health care services to provide personalised services for older adults. These services could encourage individuals to be independent, and the ways in which assistive technologies could increase productivity for health care professionals and allow them to sustain positive working environments could be explored. This work could respond to older adults' needs, especially by increasing convenience and safety. This can be done, for example, by helping them request immediate emergency responses. Older adults are able to perform daily physical activity, but due to the negative impacts of perceived health risks, unpredictable dangers can cause a reduced quality of life (Fuchs and Reichel, 2011; Harnett et al., 2020). This paper presents a solution based on the adoption of technologies, including fall detection and automatic notification of emergency services, through an ecosystem and service protocols that provide a quick response to emergency situations while allowing in-system investigations to be conducted later. By conducting this research, we not only provide an integrated healthcare services platform, but we also present the key factors that contribute to improved productivity and excellent working performance for healthcare authorities and healthcare service providers. We do this by building guidelines for employing integrated healthcare solutions. Pre-implementation and post-implementation processes are also discussed as key drivers for encouraging caregivers and local authorities to maintain the effectiveness and capability of the existing healthcare ecosystem for health promotion in developing countries.

2. RESEARCH APPROACH AND JUSTIFICATION

2.1 IoT technology adoption and acceptance

Two primary key influences on technology adoption and the invention of innovative new products are the possibility of accepting innovation and the de-

sire to maintain existing individual habits (Tsai et al., 2019). It is possible to experience both positive and negative factors. However, if there are good reasons for purchase decisions, particularly in assisting with personal needs, such as personal telehealth monitoring and providing safety and security, elderly people will find that the perceived ease of using a product affects whether it is considered an important assistance tool (Bhattacherjee and Hikmet, 2007). Experienced users focus more on usefulness and compatibility regarding their own personal needs (Zhao et al., 2018). This tendency indicates that users, especially middle-aged and older adults, seek a positive outcome when using technology products that respond to their personal behaviours and lifestyle. Decentralisation has fragmented healthcare and services in relation to specific required areas. However, this result is subject to inequalities in healthcare services for some segments of society with respect to innovations that might not be easily accessed in poor and rural areas where there are key preparation and implementation challenges in using innovative platforms to assist healthcare service providers. Therefore, education is needed to solidify tool understanding and usefulness (Arun and Holdsworth, 2020). In healthcare centers such as hospitals, patients are more likely than doctors to satisfy their own personal needs and convenience by using e-health services, especially in developing countries (Hassol et al., 2004; Hoque, Bao, and Sorwar, 2016). Support by organisations and authorities is desirable in addressing external factors or difficulties in using these systems, especially the availability of required information during the early stage of learning, which influences the understanding and acceptance of innovative technological products (Venkatesh and Bala 2008).

2.2 Health behaviours and safety perception

Adopting technology products or devices can be described as a health-related behaviour (Zhao et al., 2018). Queiros et al. 2017 stated that older adults have been satisfied when using smart technologies to assist them in overcoming emergency situations, especially when they live at home alone and require immediate emergency responses. Therefore, technological tools or equipment could improve their confidence and perceived safety in living independently and can provide personal assistance in performing physical activities because of real-time monitoring at home. Using such technology, Individuals perceived fewer risks that could possibly contribute to safety perception, leading to increased confidence in optimistically and mindfully performing activities, since they faced less anxiety and worry (Park and Reisinger, 2010; Reisinger and Mavondo 2006). The goal of adopting an e-health care service is to enable professionals to enhance their performance in responding to the needs of individuals regarding health-related behaviours with safety perceptions. The assistive tools contribute to the health care system over the long term. For example, when professionals are willing to provide better service, they decide to use technological tools to support their skills when performing the assigned tasks, and thus these tools provide convenience and more equal quality levels when providing health care services. Poor digital health literacy has been found to be one of the key barriers to implementing healthcare services. Systems must respond to the needs of users. When the healthcare workforce has been educated and has a good understanding of technology use, especially when perceiving the advantages of using technological products, they can encourage patients such as older adults to increase their physical activity with greater confidence and can track individual health information. This increased use results in older adults making active choices regarding health-related behaviours and satisfying their need for independence (Jimenez et al., 2020). Thus, both healthcare service providers and healthcare receivers have perceived the advantages of active health-related behaviours. TThey have tried to avoid risks and prefer to use innovative service products, especially when they acknowledge more perceived value such as convenience and less perceived anxiety in association with their planning and decision behaviours.

2.3 Independence and ageing in place

There is a promise of usefulness from innovative technological assistance tools that could allow older adults to lead more productive lives and contribute to the promotion of healthy behaviours and lifestyles with respect to professionals in working environments. These tools could be significant drivers in the health care system when workers recognise the usefulness of adopted technologies since it could reduce threats and negative outcomes such as complaints. For example, there are more complaints when patients perceive high uncertainty because it was not possible to provide good service and accurate health information. This can occur when there was broken communication due to unfavourable factors, such as the repetition of health information by professionals, which might be indicative of an unstable health care service system. However, innovative tools could help providers to manage all these challenges (Mostakim Fattah et al., 2017). In particular, by encouraging independence, smart technology products that have been selected for implementation at home must be considered carefully for their function and need to be designed to address key concerns, including those of technology suppliers or designers, policy makers, and healthcare providers (Peek et al., 2017). Deploying technologies and services is essential to developing an independent environment at home, and reliable sensors and platforms must be installed with appropriate devices to constantly monitor and predict daily

activities or habits to obtain real-time information and prevent the reception of incomplete daily task or activity information (Zhang et al., 2008). Therefore, to increase the capabilities of healthcare stakeholders in developing excellent healthcare mobility with affordability, especially self-health care monitoring and home healthcare service, it is necessary to consider key individual determinants, such as variable societal factors (personal), environmental factors (external), etc, in order to contribute to further development.

3. RESEARCH METHODOLOGY

3.1 Research Framework and Research Methods

This research uses both quantitative and qualitative data collected through questionnaires and semi-structured interviews with local authorities who have been transferring healthcare responsibilities in response to the personal needs of older adults. The assistive devices are proposed to be deployed, especially for older adults who are living alone and have a greater need for support. The needs and preparedness associated with technology acceptance at the pre-implementation stage for both healthcare professionals and older adults are initially considered.

To identify the factors that healthcare providers face and the ways they can overcome possible obstacles in providing healthcare services, the population of professionals is first sampled. The target population is key practitioners and policy makers who operate in two primary sectors: healthcare services and local government officers. The database for choosing the sample is from the business directories of municipal government federations, executive directors, and healthcare service directories in Thailand. To conduct the study, it is important to understand the values of key stakeholders who have decided to accept technological development, not only to assist their own assigned work but also to contribute to the goal of achieving innovative health care service mobility by health-related professionals. To select appropriate assistive devices to improve the quality of life for older adults, it is necessary to explore how to implement healthcare services that aim to provide the immediate assistance to the citizens, especially older people, equally and efficiently. Indeed, it should explore the advantages and disadvantages of healthcare utilisation in several aspects: economic, political, and socio-cultural. Thus, the study investigates various perspectives holistically and complements the established quantitative studies by providing a deeper understanding of the phenomenon in question (Altinay and Parakevas, 2008).

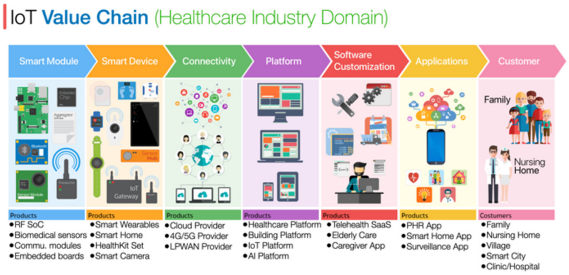


Fig.1: *IoT Value Chain for Healthcare.*

Fig. 1 presents the IoT value chain among healthcare stakeholders, including device provider, network provider, platform provider, and application provider. Note that the back-of-house implementation and the provision of convenience to the user are primary drivers. For example, the assistive devices must be simple and easy to use, because the target users are in the older population. The devices also require a stable communication network and sufficient server backups.

Afterwards, we install applications that respond to health needs as well as providing safety notification alerts to users: family members, older adults, housing care services, the local community, municipalities, and public health services. It is important for users to accept the device usefulness and decide whether they will use the assistive tools in association with their own health-related behaviours, to satisfy their lifestyle, such as the need to use personalised health care monitoring.

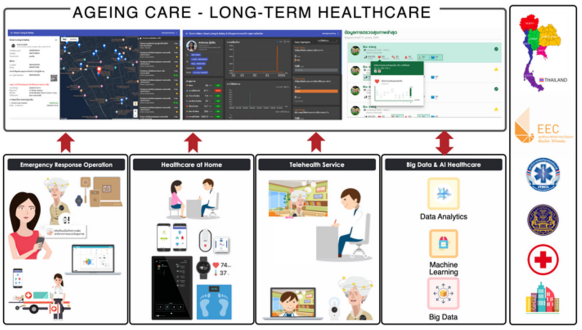


Fig.2: *Integrated healthcare for ageing in place.*

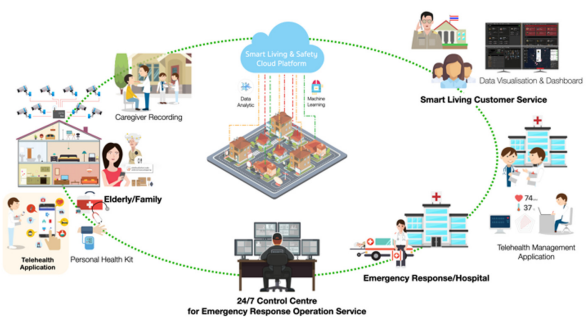
Fig. 2 shows how ageing care and integrated healthcare, such as residential care or nursing homes, are significant for allowing the older adults to live longer with good health. In cases where a technology provider that works with a system designer is not able to respond well to personal and family needs, big data analytics and artificial intelligence are used to predict and indicate anomalies. Then proper medical equipment is suggested to respond to health concerns and to address unforeseen situations and dangers based on perceived personal risks while living alone. The trial use of the proposed assistive system indicates that the

earliest emergency notifications should be put in place to address actual situations. Sometimes, the response time to an emergency has been too long. Gateway and smart devices are in place to allow a notification to be sent more quickly to the command centre, directly to the person concerned, so that a medical assistance service protocol can be implemented immediately. Healthcare at home might be necessary since it enhances independence in health-related behaviours, especially for older adults who live alone and aim to examine their own health needs.

Telehealth is also a beneficial tool for end users to exchange information with healthcare advisors via a platform. Telehealth reduces time-consuming risks at healthcare centres and allows in-person service with more privacy and confidentiality. Not only equipment and devices are essential, but also the information or relevant data provided between users and healthcare providers. This data is vital for further investigation and integrated healthcare monitoring with skilled analytics for better solutions. It can be used to track patient information accurately and can in less time, due to the information transfers to different platforms and sections within health care systems.

3.2 Sources of Data Pilot Test

To evaluate the efficiency of working performance for key stakeholders in the healthcare system, we then deployed a smart living cloud platform to assist healthcare related workers to provide assistance for older adults, especially when they live alone and require a greater level of support for independent living. In this case, the professionals and key stakeholders are recommended to adopt assistive tools and follow smart living workflows. Emergency notifications are prioritised to address risk. Home IoT devices are customized for older adults with response functions for healthcare emergency cases, as show in Fig 3.



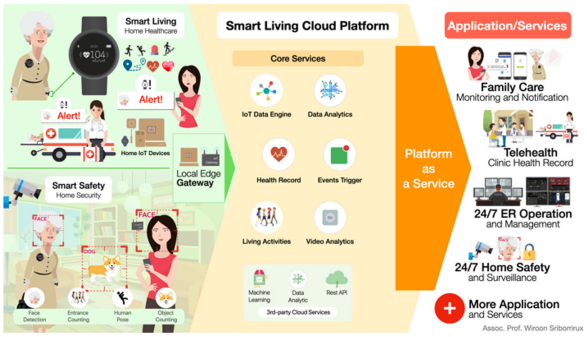


Fig.3: *Overall Data Sources for Smart Living Platform.*

In an emergency, real-time detection sends notification to the command room, where it is received by a person concerned with local healthcare services. Assistance can also be requested via devices that the individual uses or that are installed where risks may exist. For instance, an IoT gateway is installed in the living room since older people often spend time in this room. When a person needs help, he or she can request it immediately by pressing the button on the gateway. The command room and person in charge can then respond to the emergency request, by following the assistance protocol. Core services, including those related to health and safety concerns, are also provided to check, and analyse the risks and threats using video analytics, such as face detection and daily life activity logs. If an incident is suspected, the alert notification will send a request for help. Moreover, personal health records associated with telehealth assistance are considered in this platform. High levels of security with 24/7 emergency response and home safety operations are needed. In terms of supporting professionals, these assistive tools allow for more efficient work performance and contribute to the promptest provision of home care service in compliance to safety and security requrements and by following the workflows of our proposed smart living platform.

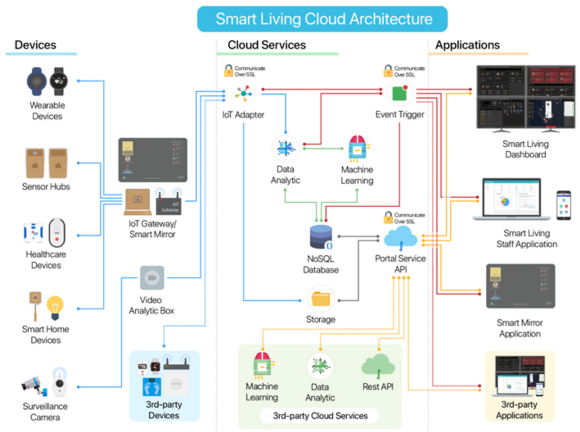


Fig.4: *Smart Living Cloud Architecture.*

Fig. 4 presents the operational framework of our smart living platform which has three main parts: designing practical devices, processing data on cloud platforms, and choosing technology that provides essential functions for specific users. The assistive devices are customized for individual needs. In this case, the key stakeholders for smart living platform determine the appropriate technology, such as mobile applications. This approach allows for better performance and increases technological acceptance by supporting an individual's health-related behaviours for more confidence in using unfamiliar technology and new assistance services. Older adults prefer to live independently because they are more likely to continue interacting with society, staying connected with other groups both in person and at a distance, so assistive technology is necessary for improving the quality of life of older people and for satisfying their personal needs. However, the proposed platform would not be beneficial for all key determinants if no proper collaboration among health-related professionals exists. Coping with health security and emergencies is important for developing longer life spans. Strong security for personal data is also important, especially personal health records. A data auditor is needed to assist in managing information and analysing the vital information to transfer to the application. Users must be trained regarding personal health information and other necessary factors. Thus, the platform allows not only the caregiver, local health command centre, and agency (third party) to acquire the data when needed, but also the users themselves. For instance, if the user wears a smart watch when she or he requires personal health information, then the watch can respond to those needs at any time.

4. EXPERIMENT AND DISCUSSION

Uncovering hidden significant factors in relation to an individual's performance helps IoT service operations and frameworks to improve their risk perception and allows for increased user confidence in performing actions. This results in increased intention and motivation to perform different tasks by increasing efficiency and productivity, particularly in different working environments or unfamiliar environments. Thus, when employing assistive technology in workflows, especially in the health care field, acquiring variable factors such as personal bias like own experience that involved in decision behaviour is needed. This helps professionals and workers acknowledge the value and usefulness of the adopted technology based on IoT development. This tool offers professionals alternatives when facing challenges. The technology adopted in the health care field is aimed at increasing positive outcomes. Indeed, the primary target group, older adults, is a major concern for the healthcare workforce. For example, anxiety in relation to uncertainty could demotivate individuals especially elderly people, that perhaps could result in their achieving fewer daily tasks. A system is needed to provide assistance. In particular, some individuals skip physical activity needed due to anxiety and uncertainty. Therefore, there is a need for better support for older people as patients who are able to identify own health risks and determine what is necessary for qualified independent living. The practical smart living platform along with assigned workflows, is suitable for achieving the healthcare goals like preventing possible risks and dangers.

Under dynamic economic growth, to respond to rapid changes, especially unstable social and economic changes, the rise of ageing population calls for preparing more health care services to respond to the higher number of health care accessibility concerns and requirements for many areas in the country. Governments and local authorities, as well as significant stakeholders in health care systems, must seek better development options for this particular necessary field. For instance, as the health care services allow more workers to tackle problems and handle unpredicted situations, one of the main impacts is that the technology tools and innovative equipment are identified as a novelty or considered unusual for their working procedures. However, once they have been educated and trained properly, these tools are able to assist individual workers well in managing urgent tasks. For example, such as when there has been a button pressed from the devices asking for urgent assistance, notification is immediately sent to all concerned and allows the key health care person in charge to respond to the situation quicker. This means it increases the possibility of overcoming problems and helps save time. Thus, using innovative technology development could be viewed as the prime solution for this friendly working environment. It is important to identify the potential drawbacks and prevent causing any further problems. In the results presented from questionnaires with medical officers, there are some confusing examples of working processes and specific roles for government officers and other concerns. These cause delays in transferring necessity information that integrates with the selected innovative tools for maintaining the quality-of-service operation. The 24.7 care center provides prompt smart living platform utilisation guidance and instructions for supporting the medical providers and so they can deliver great support for older people at home to increase convenience and healthcare efficiency. Although since our solution allows the medical officers to gain actual experience from visits as per the schedule, it allows individual roles to be adjusted. The system takes a rapid change in decision making behaviours, including acknowledging the usefulness of innovative tools and smart living service platforms via IoT development.

This research provides recommendations based on

integrated service frameworks that could contribute to the sustainability of practitioner capabilities in terms of working performance, the development of smart living, and the efficiency of social and healthcare service platforms in a long-term operation. This paper also benefits from the strengths of both qualitative and quantitative methods. Qualitative data provides an insightful understanding of the cultural and behavioural aspects of local healthcare institutions, hospitals, municipal governments, and design companies as well as the required economic, political, and socio-cultural contexts in which they operate. For example, it explores key stakeholders' s performance in terms of being collaborative by following the workflows based on the given adopted technology platform. It perhaps requires the same understanding of achieving healthcare goals. However, this data is insufficient for an in-depth understanding of the value of a tool when used and applied in a particular practice.

This work is not only focused on encouraging health-related workers to increase productivity and efficiency, but it also influences older citizens' intentional behaviours about using selected technology in their daily life. Indeed, it could allow a better social determinant of health. The equipment and smart living service platform could allow quicker identification of potential health risks as desired. With more information, it could decrease heavy workload of caregivers and reduce the traffic for basic health assessments at hospitals since older adults are able to monitor and control their own health at home. Unexpected and emergency scenarios would still be handled by the medical emergency workforce. Hence, the health care system works, once the key stakeholders, including individual health receivers, work fine. As mentioned earlier, using both qualitative and quantitative data analysis techniques, we have generated detailed, rigorous, and valid results that offer value and relevance to academics, practitioners, and policy makers.

4.1 Results of Platform Operations

The notification (sending alerts) functions by pressing a button. For example, on the wristband (Fig. 5). buttons were pressed 247 times, or 33.79% of the total notifications. There are confirmed cases by three different devices, for 28 times and 46.67% of the total requested help notifications.

Fig. 5: *Frequency of notifications.*

Figure 5 shows that a wristband device is suitable for individuals' health needs. It could ensure the positive outcomes of identifying potential risks at any time by end users since it is more convenience, and the functions meet the requirement for health needs associated with independent living. It presents 63.75% of utilisation for both functions of wristband buttons and wristband fall, when it compares with pulling the buttons by wall buttons. The design of wristband supports pressing a button at emergency requirement and falling detection well. Information above is supported by the collecting data process at the visits that is agreeable and useful for wristband wearers, especially older people.

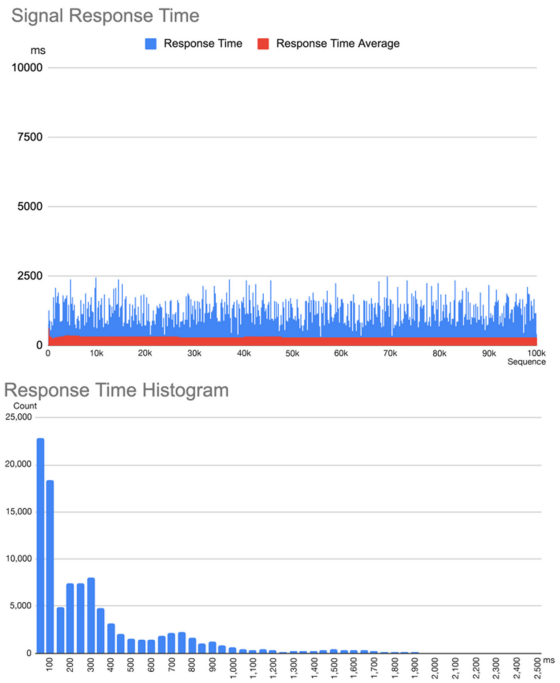


Fig. 6: *Signal response receiving period of a request and the frequency of information receipt from the devices.*

Fig. 6 shows the signal response receipt period for a request sent via MQTT broker 100,000 times continuously. It shows the frequency when sending the information every 26-2,472 milliseconds. The figure shows the average of repeating events at 299 milliseconds. Moreover, it shows the frequency histogram, which shows that the most presentable frequency for

receiving the information from devices is between 0-300 milliseconds. It shows the maximum frequency of 22,817 when receiving information between 0-50 milliseconds and 50-100 milliseconds. This figure represents 18,383 pieces of information in total.

4.1.1 Homebound Data

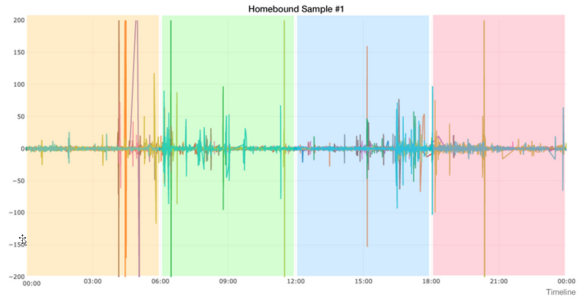


Fig.7: *Sample of activities of homebound individuals.*

Fig. 7 shows individual device-using behaviour. The daily movements and activities occur more constantly during the daytime. This figure shows the average activity is performed between 4.00 a.m. and 8.00 p.m. There are individual behaviours by older adults who are likely to be homebound and those more likely to engage in socialisation, which shows the consequences of being independent and committed to a good average of Activity of Daily Living (ADL) frequency at specific times.

4.1.2 Bedbound Data

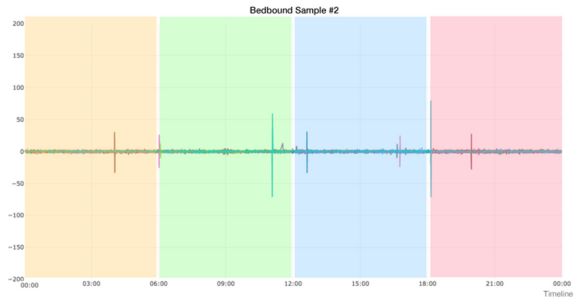


Fig.8: *Sample of activities for bedbound individuals.*

Fig. 8 shows the individual device use behaviour, with the daily movements and activities more likely to occur at a few specific times. In other words, it could show the constant movements and activities over a short period of time. The data shows the individual behaviours of older adults who are likely to be bedbound and thus not able to act independently as assessed by the performance of ADL tasks. For example, these older adults still need some more help for necessity concerns, especially in performing a greater frequency of activities and movements, when activity occurs, it may be because the patient requires physical therapy treatment and exercises by medical officers and caregivers.

4.2 Deployment and Evaluation

Our work provides empirical support to enable practitioners and policy makers to understand how to implement IoT technology for healthcare promotion. We explain how to apply an integrated service platform to contribute to risk minimization strategies and to create a smooth working environment for healthcare stakeholders.

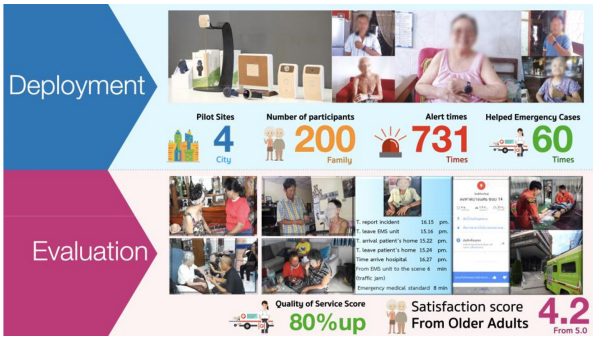


Fig.9: *Deployment and Evaluation Summary.*

Figure 9 presents the overall results of allowing practical operation for the target sample groups located in the 4 main regions of Thailand; includes Northern, Central, Eastern, and Southern. It identifies collaborative practical work for total of 12 months. It includes up to 200 households who are participating in this innovative smart living research development project. Every household received significant smart living equipment including a smart wristband, a SOS or assistance button, and an IoT Home Gateway that could send information directly to a command centre and the repeater. By using project requirement, everyone is able to participate in useful training on smart living platform with its associated benefits of with 24/7 safety and security.

It shows the result of sending notifications or alerts up to 731 times mentioned earlier for the usefulness of selective devices by individuals' health needs in figure 5. Figure 9 shows sending requests for emergency assistances 60 times. This indeed explores the results of efficiency in providing assistance at earliest time, reducing potential risks like slow discovery of cases and handles health issues with prompt medical treatment. Satisfaction scores show 4.2 of 5% or more than 80% satisfaction from all target samples like older adults from every household. It shows the fact that the deployment of innovative smart living platforms is appropriate in a healthcare system, especially since it allows more capability of independent living for older people and increasing efficiency of workflows by the healthcare workforce.

In terms of social impact, our work supports local healthcare service providers, municipal governments,

executive directors of healthcare organisations, and smart living developers to facilitate individual adoption of assistive technologies with high value and usefulness. It also empowers healthcare practitioners and policy makers to use and respond to the strategic plan to develop excellent performance within organisations by enhancing active teams by means of increasing technology development capabilities in a required area and healthcare field. This approach strengthens individual performance when using e-healthcare systems based on assistive technology development, such as employing IoT integrated service platform and procedures. This technology is necessary for enhancing the quality of living for all citizens. In this case, it focuses on encouraging more of the ageing to use a technology platform and emphasises the important roles of technology use. In summary, we have explored and evaluated the impacts and factors that influence development and collaboration by allowing better workflows of key healthcare stakeholders and by following integrated smart living platform and service protocols.

5. LIMITATIONS AND FUTURE RESEARCH DIRECTIONS

The limitations of acquiring more useful information through our implementation are due to a lack of knowledge among practitioners and key healthcare-related individuals regarding the adoption of innovative tools and using technology to facilitate their own performance and provide a quick response to emergency situations when there are requests for assistance from older adults living alone. In other words, the key determinants are education and being equipped with a strong understanding of the technology values and selecting assistive tools based on IoT technology development. In the future, it could build a similar understanding for achieving health goals and improving the quality individuals' lives. In particular, in the evaluation of social and healthcare services, to compare with the traditional health care service providers, if technologies and smart devices are not implemented at home, the provision of an immediate emergency response when older adults face injuries is much less efficient. Thus, the adopted IoT technology devices and platforms are important for increasing worker and professional capabilities that involve decision behaviour with a primary role of handling assigned tasks associated with potential health risks.

Further research could consider evaluating the implementation of smart devices in relation to integrated service platforms for empowering professionals and health-related workers to monitor individuals when they use the assistive equipment to support their independence outside the home. Innovative tools and applications could allow individuals to increase family and community connections. This approach increases the responsibility of healthcare service professionals to investigate health-related behaviours and assess the risks through proper risk mitigation and action plans. For example, using technology products based on IoT platforms to address health risks and responding to the post-COVID-19 pandemic context might be considered.

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