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Innovation and Creativity in ICT

WHO reported that the global population over 60 years old would continuously grow from 900 million in 2015 to 2 billion projected in 2050 [1]. Various health issues are emerging with the aging population including falls, dementia, delirium, pressure ulcers, incontinence and frailty. Dementia is one of the most concerned issue among these health issues. With over 46 million people living with dementia worldwide today, it is recognized as the world's next epidemic. Projected number of people aged 60 or above with dementia in Hong Kong will increase by 222%, from 103,433 in 2009 to 332,688 in 2039[2]. Apparently, costs of long-term health and social care will dramatically increase, causing considerable economic burden. Wandering is a common behavioral disorder found in people with dementia. Night activity monitor is important measure for preventing them from wandering around at night. It was reported that 70% of the caregivers regarded wandering as a risk for the care of the patients[3]. To address the issue, caregivers commonly use different restrict tools such as drugging psychotropic medications, strait jacket, side rails, infrared bed leave sensor, pressure map (sensitive alarm) for preventing exiting bed and alerting caregiver when happening. Among these tools, physical restraint is the most common measure for preventing elderly from wandering and falls. However, these tools and measures could worsen elderly's quality of life and mental condition. Additionally, elderlies are wakened up several times per night for vital-sign checking, leading to sleep deprivation and agitation.

It is not difficult to imagine that an elderly under restraints but with needs of stretching his/her limbs, using bathroom, and drinking water will not be able to satisfy these needs at his/her own-well. This will make the restraints considerably affect the patient's mental health. Bed-exiting sensors and alarm are alternative However, the effectiveness of infrared and pressure-map based bed leaving sensors for alerting bed-leaving has been largely concerned[4]. caregivers o need to frequently check device functioning. In addition, these measures also lead to an ethical issue about restricting the freedom of people with dementia. Apparently, there is a glaring need for developing a non-constraint system for monitoring these patients at night.

The eNightLog system aims to resolve these problems aforementioned. It provides elderly's sleep and activity monitoring at night, delivers alarm to caregivers for elderly's abnormal behavior, and further sooth elderly by lighting and aroma. Non-contact ultrawide band radar vital sensing and 3D infrared imaging technologies are integrated in this system to monitor elderly's vital signs and activities during sleep with least setup effort. The product can be completely hidden in a false ceiling or stand alone in form of a lamp. The significance of this product includes facilitating high-quality care of the elderly with dementia, improving their quality of sleep and quality of life, while reducing the manpower and financial burden on the society.

Functionality

1. Remote sensing approach for monitoring service user's respiration rate and sleep quality by using ultrawide band radar
2. Alert elderly's bed exiting activities using 3D infrared time of flight sensor
3. Identity different human body postures and activities
4. Allow customized alert settings for individual user, including heart rate and temperature, using wearables linked to the system
5. Deliver message, image, and video to the caring facility and/or care-giver
6. Support remote service and maintenance using IoT technologies
7. lighting colour and intensity control with preset timer and weather information.
8. Control the timely released aroma for easing behaviour problems of elderly.
9. Link to smart diaper for alerting diaper replacement in need.
10. Database tracking record and automatic report to preset email or SMS.
11. Scalable to use for various size of hostel.

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[1] World Health Organization. 10 facts on ageing and health 2019 [Available from: https://www.who.int/features/factfiles/ageing/en/

[2] Yu R, Chau PH, McGhee SM, Cheung WL, Chan KC, Cheung SH, et al. Trends in prevalence and mortality of dementia in elderly Hong Kong population: projections, disease burden, and implications for long-term care. Int J Alzheimers Dis. 2012;2012:406852.

[3] Utton D. The design of housing for people with dementia. J Care Serv Manag. 2009;3(4):380-90.

[4] Capezuti E, Brush BL, Lane S, Rabinowitz HU, Secic M. Bed-exit alarm effectiveness. Arch Gerontol Geriatr. 2009 Jul–Aug; 49(1): 27–31

Market Potential/ Performance, Internal User Buy-in or Public Acceptance

Elderly home operating organizations and individual caregivers are constantly facing the same problem on night caring. With society is rapidly ageing, the need of elderly resident home and trained staff are soaring rapidly. Our product could be the effective way to mitigate the issue. There are over one million elderlies in Hong Kong. it can be estimated that more than 100,000 client units are required to satisfy the demand.

Since October 2018, the Jockey Club Charities Trust had funded a community project entitled the "Jockey Club Smart Ageing Hub". With the generous fund obtained, a Day Experience Centre equipped with a set of eNightLog system was established within the university campus. The eNightLog system installed within a Smart Home Show Flat of the Centre allows the project team to showcase and demonstrate the practical usage of the system to the local and overseas professionals as well as providing the first-hand trial experience for visitors.

In addition, the project also further support the application of the eNightLog system at 4 existing elderly nursing hostels, namely, the Jockey Club Centre of Positive Ageing (JCCPA), Haven of Hope Christian Service Woo Ping Care & Attention Home, Fu Hong Society Chak On adult training centre, Yan Chai Hospital Lei Muk Shue Rainbow Court. Aiming to enhancing the elderly care services, especially the night care system at the hostels, the eNightLog system shall be implemented on-site for service advancement. JCCPA is the first hostel that completed the installation and the system is now being used for daily operation. An industrial visit was held in late October 2019 for demonstrating the practical operation & usage of the eNightLog system and sharing experience with those professional stakeholders from various sectors (i.e. Elderly care service providers, developers, engineers, social welfare workers etc.). While the installation of the eNightLog system at the other 3 hostels is still under progress, the project team had already received overwhelming enquiries from NGOs showing their interest in equipping the eNightLog at the existing or newly-built hostels. Moreover, requests on further application of eNightLog, including expending its usage at rehabilitation centres and home care are also received from the public.

Benefits and Impact
- Releasing the caregiver's workload while increase the quality of life of elderly, particularly for elderly with dementia and/or frail. This is because it can eliminate unnecessary checking and night visit.
- Improved elderly's care management by remotely monitoring sleep, posture, and vital sign using central monitor server and service user management system.
- Manager can easy access the service performance and management by studying automatic daily report.
- Integrating light and aroma therapy and smart diaper for maximizing the well-being of elderly
- Longitudinal monitor and track of elderly's sleep quality and health condition, allowing better planning on elderly caring
- Reducing or eliminating the time consumed on constant device setup.
- Potentially eliminating physical restraint.
- Reduction in labour cost per service user while improved quality of life elderly.

More Details and Video
Press release: https://www.polyu.edu.hk/bme/news-and-events/news/2018/enightlog-system/
Video: https://www.youtube.com/watch?v=P7felXpcG64

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