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Headline: Intergrated approach to ageing in place

ScienceTalk

Integrated approach to ageing in place

Existing elderly monitoring systems are not user-centric and do not operate with other home automation systems

Tan Hwee Pink

Globally, the population of seniors has been projected to surge, increasing from 530.5 million in 2010 to 1.5 billion last year.

In 2014, 12.4 per cent of the population in Singapore was above 65 years of age and this is projected to increase to 19 per cent by 2030. Alarmingly low birth rates in Singapore, together with increasing healthcare costs and limited availability of healthcare professionals, necessitates "ageing in place" – living where you have lived for years, not typically in a healthcare environment or nursing home, and using products, services and conveniences which allow you to remain at home as your circumstances change.

In Singapore, the number of elderly people living alone is likely to increase to 83,000 by 2030, up from 35,000 today. The incidence of chronic illnesses is also on the rise among this vulnerable segment of our society, making it increasingly likely for them to rely more and more on social care.

Ambient intelligence environments that monitor a loved one's activities 24/7 are now a part of the caregiver landscape, and are here to stay.

These new technologies now enable family members to give care remotely and check in with loved ones – while providing healthcare professionals with real-time information.

Other relevant technologies include online medicine cabinets that track usage; sensor-infused toothbrushes that monitor a diabetic's insulin levels; stoves that turn themselves off when owners forget to; intelligent toilets that test for urine sugar levels, body fat and blood pressure; smart spectacles that help those with vision loss to navigate their homes; beds that can monitor patients' vital signs as they sleep; video games that detect early signs of dementia; robots which will provide help with daily activities, the list goes on.

These are already available – either as commercial products or experimental prototypes.

There are many voluntary welfare organisations that focus on enabling ageing in place for the elderly living alone in Singapore, such as the Lions Befrienders Service Association (LBSA) and GoodLife!

Activities that they offer include elderly befriending services through scheduled home visits and running senior activity centres (SAC) that provide activities in HDB estates to keep the elderly socially and physically engaged. LBSA, for example, has six such centres in various estates here, and is one of the most established VWOs in Singapore.

Despite all efforts, however, in the last five years there have been more than 50 cases of the elderly who lived alone dying at home. And it took days or even weeks before someone found out.

This has triggered various government ministries and agencies, including the Ministry of Health

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Many VWOs offer elderly befriending services that provide activities in HDB estates to keep the elderly socially and physically engaged. ST PHOTO: JAMIE KOH

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(MOH), Housing Board and the Ministry of Social and Family Development (MSF) to step up efforts to mitigate this.

In an effort to consolidate VWO-led care provision for better efficiency, MSF announced in 2014 that Singapore will be divided into six zones, and that a lead VWO would be appointed to manage all the SACs in the respective zones.

And to make the home-visit befriending services more attractive, the MSF also announced an incentive of $5 to be given to housewives or retirees for each home visit conducted.

On the technology front, HDB and MOH have initiated pilot projects to develop and deploy elderly monitoring systems (EMS) in HDB flats occupied by lone elderly residents.

These in-home monitoring and alert systems can monitor the activity levels of each resident in a non-intrusive way, and trigger an alert to a caregiver in the event of anomalies (such as extended non-movement which could point to a fall).

In 2013, a similar laudable community-driven initiative, The Helping Hands, led by The New Paper, LBSA and Ngee Ann Polytechnic, managed to raise $1 million to deploy such EMS in 500 homes.

What more can be done to enable and sustain ageing in place?

While the initial pilots of the EMS are promising, a foreseeable limitation lies in the fact that these systems, as with most ambient intelligence systems, are technology-centric (as opposed to user-centric), proprietary and operate in silos: They are not designed to interoperate with other home automation systems.

Continuing with the current trend would result in multiple systems from different vendors in each home, and, with unclear business models (that is, who pays for what), their adoption is likely to remain limited.

In terms of meeting the needs of care provisioning, we are merely scratching the surface.

While the primary-use cases are centred on real-time alerts, a wealth of useful information can be derived from extended EMS (featuring other sensors capable of monitoring medication consumption, appliance usage and so on) that can lead to more targeted and personalised care provision and intervention, resulting in improved overall well-being for both the elderly and the caregiver.

The cross-disciplinary team at the SMU-TCS iCity Lab, a joint venture between the Singapore Management University and Tata Consultancy Services, focused on research and development of intelligent and inclusive city solutions.

It is taking the lead to strengthen the integration of ambient intelligence systems and care provisioning through research and development collaboration with our partners, including the Agency for Science, Technology and Research (A*Star), as well as key end-user stakeholders, including GoodLife!, the Eastern Health Alliance and LBSA.

These research projects are supported by Singapore's government ministries.

As an example of user-driven design, in our medication adherence study we surveyed 10 old people, most suffering from multiple chronic illnesses that call for them to take medication once to three times daily, to understand their medication habits.

Given the wide variability, we designed a monitoring system where each person was given a box with one, two or three compartments, in different colours. A sensor was attached to monitor its usage and the information was communicated to a hub, which then sent the information back.

The open architecture adopted by the hub means that it is extensible and can also communicate with additional in-home sensors as needed. This minimises the disruption to the user's existing habits while taking into account individual preferences and habits, such as frequency of medication.

Because the system is easy to use, and works well, people in our study continued to use our medication boxes, which in turn allowed hospitals and medical professionals to monitor patients remotely and step in if needed, through a reminder buzzer or phone call, for example, if medications were missed.

The open architecture also ensures that additional sensor modalities can be easily and effectively integrated into the monitoring system, thus increasing the likelihood of sustainable adoption.

Beyond real-time alerts, higher-level knowledge ranging from frequency and duration of visits to the bathroom, to sleep quality – extracted from the EMS at set intervals – can provide meaningful insights for our care-provision partners, bringing us a step closer towards truly achieving sustainable ageing in place.

STscience@sph.com.sg

About the writer

Dr Tan Hwee Pink, 45, is an associate professor of information systems (practice) at the Singapore Management University (SMU).

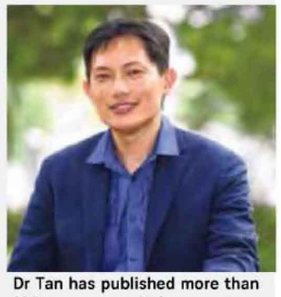
He is also academic director of the SMU-TCS iCity Lab at SMU, where he leads a team of researchers to bring together Internet of Things technologies and social behavioural research to enable and sustain ageing in place – leading, in a broader sense, to intelligent and inclusive societies.

He is the principal investigator for ShineSeniors, an SMU-initiated effort to make community care services effective through innovations in care delivery, such as by creating sensor-enabled homes in support of ageing in place.

His research has focused on the design, modelling and performance evaluation of underwater acoustic sensor networks, wireless sensor networks powered by ambient energy harvesting, as well as large-scale and heterogeneous sensor networks.

He has published more than 100 papers and has served in executive roles for various conferences on wireless sensor networks.

He recently co-founded and is chair of the technology and innovation committee of the Stroke Support Station, a registered charity that aims to help stroke survivors re-learn and enjoy active living for a better quality of life.



Dr Tan has published more than 100 papers on wireless sensor networks. PHOTO: SMU