

# An Extensible Event-driven Care Notification Platform for Caregivers through Curation of Multi-Vendor, Multi-modal Data from Smart Home Technologies

## Project Description

As countries move into an aging society with an expected decline in caregivers for elderly and infirm, load of caregiving must be eased to prevent caregivers from experiencing 'caregiver burnout'. In Singapore context, many measures have been put in place by Agency for Integrated Care (AIC) to better equip caregivers with the right knowledge and skills to care for their loved ones. However, coupled with the demands from a working lifestyle, there is a noticeable lack of efficiency in the level of care. A more holistic and efficient care model should be in place to allow caregivers to respond quickly to significant events and situations.

In the current landscape, Assistive Technology (AT) and Internet of Things (IoT) have been leveraged to increase the quality of life and autonomy of beneficiaries. Through an ecosystem of interconnected sensors, heterogeneous devices as well as software applications, insights can be drawn from a beneficiary's health, overall well-being and daily living patterns. However, current technology offerings in the market have limitations in the following ways:

- ***In-silo systems.*** There is currently no industry standard for managing devices and services, for care provisioning in the social sector. In addition, vendors and manufacturers tend to offer devices and corresponding systems that are vertically integrated and which are in-silo, thus making it hard to integrate technology from different vendors.
- ***Lack of customizable care, response and intervention models.*** Alerts and notifications are an important component in systems used by home and community caregivers. Different groups of caregivers (both individual and community) work with different care models and require different levels of responders. Most proprietary systems lack the flexibility and means for the caregivers to make modifications to the care model - for instance, the number of levels of care and escalation protocols.
- ***Lack of targeted alerts and notifications to caregivers.*** Most elderly monitoring systems require care service providers to plough through tons of data in their day-to-day operations, and are not efficient as a service model. Existing systems typically provide user interfaces (UIs) in the form of time-series charts and graphs that conglomerate multi-modal data sources, which can be overwhelming to the caregivers and interfere with their daily care routines. A more responsive and targeted approach to providing alerts and notifications is necessary for caregivers, to enable them to focus on care provisioning for a larger group of beneficiaries, while being able to respond to significant events or situations, in a more timely manner.

With the above problem statement, we would like students to develop a web-based platform that enhances the care, response and intervention for beneficiaries in the social sector. The platform should enable ingress of data from multiple sources (e.g. solutions vendors, consumer devices, etc) and allow users to create events of interest, deriving from these data sources. These events of interest may be created using 'rules' (e.g. chains of conditional statements) to link the data and alerts. In addition, the platform should allow for customization of notifications and alerts.

## Project Deliverables

The project deliverables include a web-based care notification platform to empower **caregivers (health- or social-care) of elderly (post step-down care at the community hospital)** through: (i) curation of data, which ensures that only useful and significant real-time events are pushed to the caregivers; and (ii) flexible and personalized care and intervention models. Key features of platform include, but are not limited to:

- Support for multiple data inputs (from various solutions vendors, consumer devices or otherwise)
- Functionalities to create events from Activities of Daily Living (ADLs) derived from multiple data inputs
- Rule-based engine to compute thresholds to drive events and triggers
- Customizable alerts and notifications module for caregivers with support for SMS and emails
- An good UX for non-tech savvy users
- A well-designed web application architecture for scalability, security and extensibility
- A responsive User Interface (UI) for both web and mobile users

## Project Sponsors

The SMU-TCS iCity Lab is embarking on a long-term research collaboration with the Geriatric Education and Research Institute (GERI) to improve care for the elderly through the use of smart home technologies including Internet of Things.

GERI was set up in 2015 as a national entity under Ministry of Health (MOH) Singapore dedicated to develop, coordinate and implement various initiatives to strengthen geriatric education, research and service planning in the clinical and health service aspects of aging. It houses a home-like Smart Home Living Lab (SHLL) (a 3-room HDB flat with living, kitchen, bedrooms and bathroom) within the Yishun Community Hospital – an invaluable facility for validating R&D through on-site test-bedding on selected clinical population.

The key objectives of the iCity-GERI collaboration is to evaluate smart home technologies to detect specific ADLs/iADLs of elderly patients, translate them into meaningful events, and trigger personalized care and intervention in a home-like environment prior to rollout in actual homes.

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