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Improving Independent Living and Quality of Life for Dementia Patients with Open-Interface Sensor-Based Home Monitoring

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Abstract. Living with dementia is a challenging journey for both those with dementia and their families. Besides memory loss and cognitive decline, persons with dementia often face challenges of independent living and loss of quality of life. To enhance and extend the period of independent living, an open-source software and commercial sensor-based home monitoring system is being developed. These sensors are relatively compatible with home environments, can be personalized for different users, and provide constant support including reminders, also allowing for early identification of physical or behavioural changes. They assist not only in managing everyday activities of people with dementia but also provide their carers with peace of mind.

Keywords. People Living with Dementia (PLwD), Sensors, Home Monitoring Automation, Commercial off-the-shelf (COTS), Open-Source

1. Introduction and Methods

There are currently 64,000 people living with dementia (PLwD) in Ireland, and this number is expected to more than double, reaching over 150,000 by 2045 [1]. With rising prevalence, integrating self-care and self-management through sensor technology is potentially a cost-effective way of prolonging independent living and improving the quality of life [2]. This paper introduces a new open-source software and commercial sensor-based home monitoring framework [Fig 1(a)] that aims to help people living with dementia (PLwD) maintain independence. These sensors are open interface customizable based on wireless protocols and easily available based on commercial off-the-shelf (COTS) devices [3] and the framework is designed to adapt to emerging technologies, making it future-proof. Currently, the system is implemented by using various sensors connected to a central hub, managed by Home Assistant as the open-source automation platform [4]. By integrating with Google Assistant [5], it provides voice prompts for essential tasks like taking medication, and alerts for safety risks such as an open house door, stove or refrigerator [5]. The system automates smart home sensors, together with

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a smart calendar and smart pill box that sends reminders through a phone or smartwatch and supports well-being by prompting hydration and nutrition activities [Fig 1(c)]. It also tracks outdoor activities via smartwatches and GPS air tags [6], for example sending shopping reminders when near a supermarket or pharmacy [Fig 1(b)]. This automation reduces caregiver burden and helps people with dementia maintain their independence.

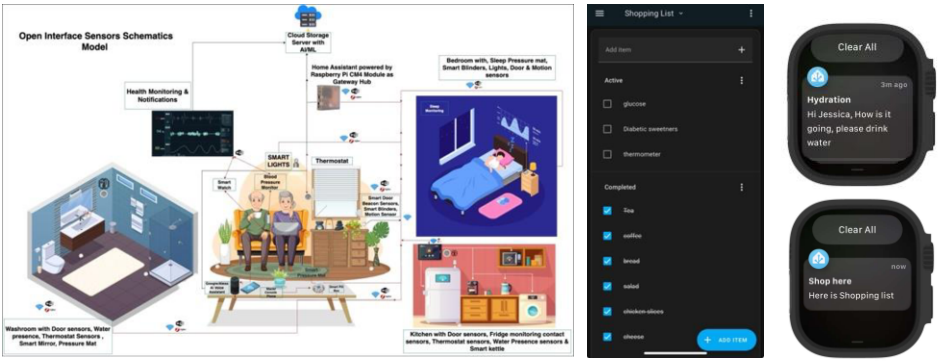

Figure 1. (Left to right) (a) Schematics of the smart home monitoring (b) Shopping list notifications on phone (c) Hydration reminders on smartwatches.

2. Results, Discussion, Conclusions and Future Work

This proof of concept showed that integrating sensors and Google Assistant with Home Assistant effectively automates routines in the testing phase. Future work will focus on validations and involving people with dementia and carers in co-designing and co-evaluating the solution and addressing any ethical concerns associated with deploying sensing technologies in such a sensitive context. These solutions are designed to be safe, secure, user-friendly and respectful of PLwD's dignity and autonomy, to integrate advanced AI features, and to adhere to EU regulations, ethics and compliance standards.

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