Smart Room for Elderly ADL Monitoring using Passive RFID sensors

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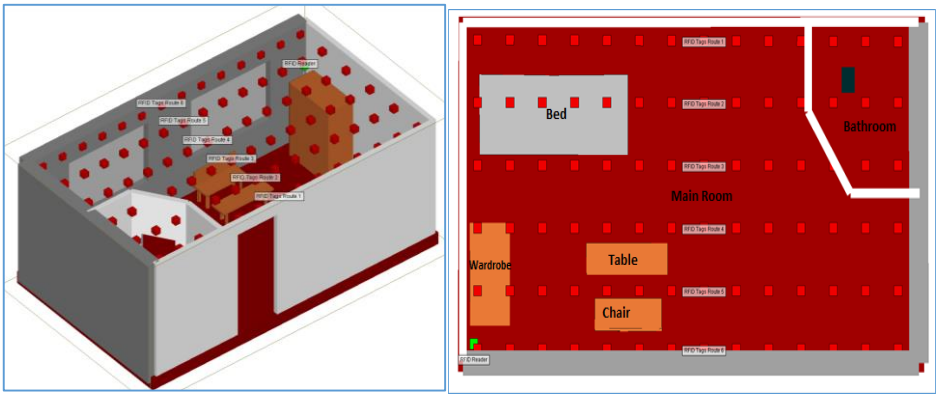
The growing advancement in wireless communication technologies and medical sciences have enabled several approaches to electronic health (e-health) thereby improved healthcare services and applications. Consequently, improved healthcare service has significantly contributed to longevity experienced worldwide, resulting in the high number of the elderly (i.e. people above 65 years or over). The increasing number of the elderly is expected to geometrically grow by 56 per cent between 2015 and 2030, resulting in an increase from 901 million to 1.4 billion in size and this growing number is expected to be more than 2 billion as at 2050 making the elderly a major contributor to the world population [1, 2]. However, living longer comes with various health challenges due to increase in various chronic and degenerative disease such as Alzheimer and dementia, Parkinson, osteoporosis, and incontinence [3, 4]. These diseases render critically-ill patients and elderly in hospitals and healthcare home frail, vulnerable, helpless and most times in need of assistance for activities of daily living (ADL). Moreover, elderly patients with dementia over a long period of time often times exhibits psychotic behaviour as identified in [5], which further necessitates the need for constant physical assistance and prompt medical response. Thus, this paper proposes a new dimension to non-invasive, unobtrusive monitoring of patients for ADL such as fall, sit stand, sleep and even using the bathroom is proposed using the variation in the received signal strength of RFID tags in determining the activities of an elderly patient.

In designing the smart room (see Fig. 1), a simple suite of passive RFID system operating at 920MHz in a bandwidth of 92 MHz is installed, in order to achieve better precision and higher accuracy. The component of the proposed is divided into two parts: the main room and the bathroom. The overall dimension of the room is divided equally into six signal routes of passive RFID tags. Each route consists of 14 tags of equal space, and the room contains a total of 84 tags. Route 1 and 6 are positioned at a height level of 3m on the walls of the room, while route 2, 3, 4, and 5 are strategically positioned on the ceiling level of the room.



(a) (b)

Fig. 1. (a) 3-D and (b) schematic layout of components in the proposed Smart Room; Reader (green), RFID tags (red).

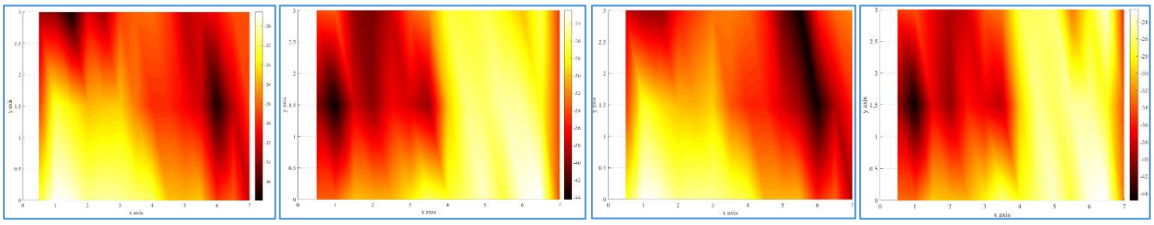


Fig. 2: RSS for various patient movements within the smart room.

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