Development of a fall prevention device for older persons

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Purpose The ever-increasing ageing population has raised awareness globally. The deterioration of health among older persons commonly leads to an increased risk of falling. The desire to live independently has the consequences for them and society as well. Enabling environments for older persons can be created, easing the social challenge of preparing for an ageing society while improving quality of life in their golden years. Technology solutions have been a game-changer supporting the families as the default caretakers for ageing relatives, bringing peace of mind. Fall detection systems represent one of the assistive technologies for older persons, as they can offer immediate assistance in case of emergency. Albeit the usage of the device is statistically low in Malaysia, they have been known to save lives (Bourke et al., 2010). Studies regarding fall detections and balance intervention have resulted in increasing safety, improving gait and physical activities (Lin & Wai, 2021; Hsieh et al., 2018). This study aims to improve the device by incorporating balance monitoring system, delivering better care for older persons. Rather than simply detecting falls, the proposed system will monitor balance instability, alerting the user to predict future falls and therefore serving as a fall prevention device. **Method** A simulation-based study has been developed to monitor balance instability of older persons. A fall prevention algorithm is proposed to be integrated with fall detection devices, where two notable variables of balance were selected as the inputs for the system: Limit of Stability (LOS) and Degree of Sway (DOS). Findings are validated using real data of older persons' LOS and DOS, adopted from a previous research by Ashari (2007) which used Neurocom™ Balance Master for balance analysis. The balance instability is then analysed using fuzzy logic and categorised as low, medium, or high; signified as the fall risk level (Figure 1). The classification will be displayed in the balance assessment while the system concurrently detecting fall events. **Results and Discussion** This study demonstrates a fall prevention algorithm to improve the accuracy of fall detection systems while monitoring balance instability. The system will notify the user if there are instabilities detected to avoid falling or prolonged loss of balance. When the simulation is initiated, the system will continuously monitor older person's stability while detecting falls. Results will display balance category with an indicator displaying fall risk level and notifications of actions to be taken for safety purposes. Figure 1 demonstrates the balance assessment of a user with low level of stability, thus the fall risk indicator level becomes high and necessary actions is taken immediately via the system. Analysing balance instability among older persons is an important aspect for their daily monitoring and to be aware of their conditions periodically. This will help health care professionals to provide proper rehabilitation if needed. The enhanced fall detection and balance monitoring can bridge the gap between family members' concerns and one's desire to stay independent. The proposed fall prevention system can increase safety in daily life; encouraging older persons to practise active ageing.

References

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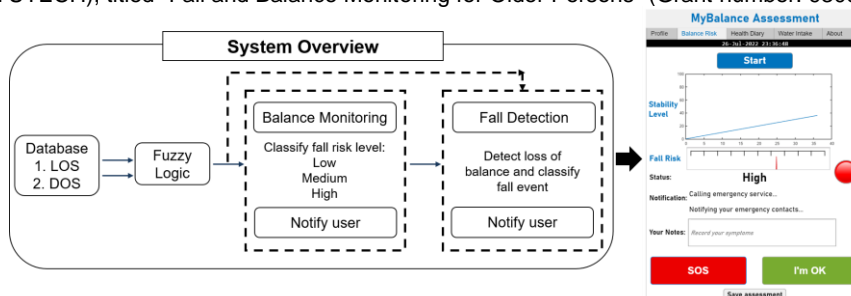
Figure 1. Fall prevention system development.