Easy-Assist: An Intelligent Haptic-based Affective framework for Assisted Living

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Abstract

This research is focused on developing a wearable affective framework, which can help in detecting the emotions of the user in addition to monitoring their physiological signals. The proposed framework can be used in an automated assisted living environment, where the user's emotional state can be balanced using a haptic-based emotional elicitation system after the user's emotion is recognized, detected and interpreted in real-time. The proposed framework is validated using a fall detection algorithm deployed in a watch wearable, built using off-the-shelf components.

Research Work

A framework that can be used in an automated assisted living environment, where the user's emotional state can be balanced using a haptic-based emotional elicitation system after the user's emotion is recognized, detected and interpreted in real-time.

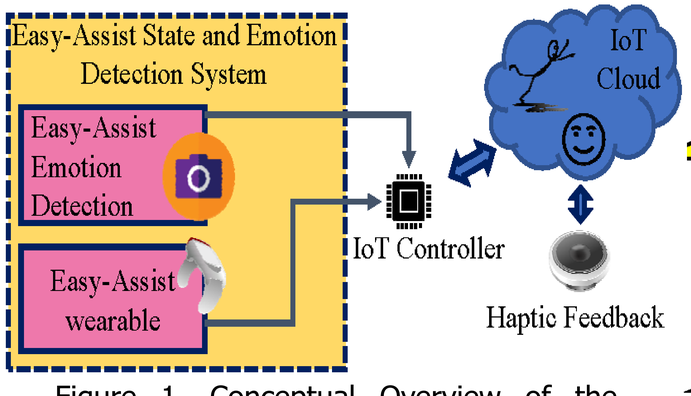


Figure 1. Conceptual Overview of the proposed Easy-Assist framework

Novel Contributions

The contributions of this research are:

- A novel haptic-based Affective framework for fall detection and emotion recognition.
- A novel fall state detection algorithm along with the feedback routine.
- A novel state and emotion detection algorithm has been proposed.
- The proposed fall detection algorithm is validated using a custom-built wearable.
- The proposed framework is validated using cost-effective components.

Proposed Algorithm

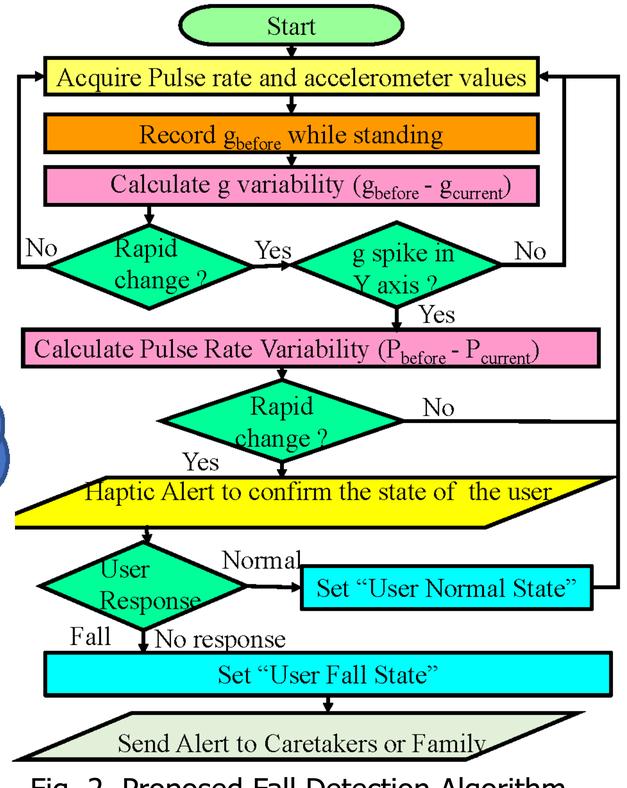
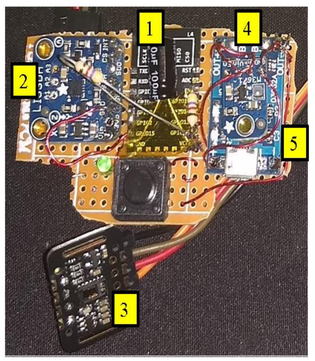


Fig. 2. Proposed Fall Detection Algorithm

Experimental Results



1. ESP8266 12E - Microcontroller
2. LIS3DH - Accelerometer
3. MAX30102 – Pulse Oxygen Sensor
4. LIM3671 (top) – 3.3 voltage Regulator
5. TC4056a (bottom) – Battery Management System

Fig. 3. Prototype of Easy-Assist Wearable

- ✓ The data obtained using the custom-built Easy-Assist wearable was labelled into 5 state classes.
- ✓ A dataset of 21700 samples acquired using the proposed framework yielded a maximum efficiency of 97.25 %, 96 %, and 94 %, in classifying the state and emotion classes into Alert, Active and Normal classes respectively, using multi-class SVM model.

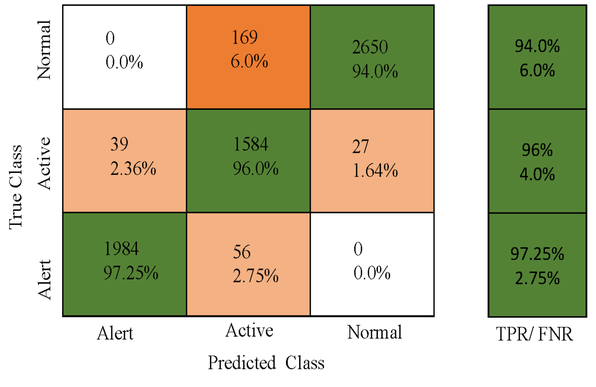


Fig. 4. Confusion matrix of multiclass activity classification using state and emotion features extracted from Easy-Assist framework

Conclusion and Future Research

The proposed research included design of efficient hardware prototype, Easy-Assist wearable along with the emotion detection framework based on Raspberry Pi 3+. Future directions of this research includes deploying multiple applications in the proposed framework in addition to fall detection. Additionally, the use of fully immersive environments such as head mount displays and virtual reality headsets are to be investigated for this application.

References

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[2] M. Chen, J. Zhou, G. Tao, J. Yang, and L. Hu, "Wearable Affective Robot", *IEEE Access,* Vol. 6, pp. 64766 – 64776, 2018.

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