Use of Wearable Miniaturised Medical Devices With Artificial Intelligence (AI) in Enhancing Physical Medicine

Kaya KURU[1]

[1] School of Engineering and Computing, University of Central Lancashire, Preston PR1 2HE, U.K.

Abstract:

High-quality data needs to be acquired from patients at the right time not only to build effective intelligent diagnostic decision support systems (DDSSs) and medical decision-making (MDM) tools without tedious data preprocessing steps but also to trigger the most appropriate means of treatment at the proper time [1], ideally in an autonomous manner without physician intervention. Within this context, wearable miniaturised medical devices instilled with Artificial Intelligence (AI) techniques [2] equipped with geo-distributed intelligence [3] have been taking their indispensable places in the medical field with numerous sub-disciplines [4], [5], [6], [7], [8], [9], [10] to take care of patients while they are performing their daily activities. The recent advances in miniaturised mechatronics systems [11], sensor technologies, and AI expedite the development of such devices.

Miniaturised sensors are the essential components in developing miniaturised wearable devices to perceive continuous health conditions through uninterrupted tight coupling with the human body. This research analyses the non-invasive wearable miniaturised medical devices, essential sensor components to acquire high-quality health data, and AI used in these devices to build MDM and DDSSs for improving the daily routines of people with quality suggestions, alerts, and directions.

REFERENCES

[1] Kuru, K., et al. (2013). A novel report generation approach for medical applications: The SISDS methodology and its applications. In International Journal of Medical Informatics (Vol. 82, Issue 5, pp. 435–447). https://doi.org/10.1016/j.ijmedinf.2012.05.019

[2] Kuru, K., et al. (2018). Novel hybrid object-based non-parametric clustering approach for grouping similar objects in specific visual domains. In Applied Soft Computing (Vol. 62, pp. 667–701). Elsevier BV. https://doi.org/10.1016/j.asoc.2017.11.007

[3] Kuru, K. (2021). Management of geo-distributed intelligence: Deep Insight as a Service (DINSaaS) on Forged Cloud Platforms (FCP). In Journal of Parallel and Distributed Computing (Vol. 149, pp. 103–118). Elsevier BV. https://doi.org/10.1016/j.jpdc.2020.11.009

[4] Caswell, N., et al. (2020). Patient Engagement in Medical Device Design: Refining the Essential Attributes of a Wearable, Pre-Void, Ultrasound Alarm for Nocturnal Enuresis. In Pharmaceutical Medicine (Vol. 34, Issue 1, pp. 39–48). https://doi.org/10.1007/s40290-019-00324-w

[5] Kuru, K., et al. (2020). Intelligent autonomous treatment of bedwetting using non-invasive wearable advanced mechatronics systems and MEMS sensors. In Medical & Biological Engineering & Computing (Vol. 58, Issue 5, pp. 943–965). https://doi.org/10.1007/s11517-019-02091-x

[6] Kuru, K., et al. (2018). Feasibility study of intelligent autonomous determination of the bladder voiding need to treat bedwetting using ultrasound and smartphone ML techniques. In Medical & Biological Engineering & Computing (Vol. 57, Issue 5, pp. 1079–1097). https://doi.org/10.1007/s11517-018-1942-9

[7] Kuru, K., et al. (2023). Treatment of Nocturnal Enuresis using miniaturised advanced mechatronics with Artificial Intelligence. IEEE Journal of Translational Engineering in Health and Medicine, vol. 11, pp. 1–10.

[8] Ansell, D. W., et al. (2017). Methods and apparatuses for estimating bladder status. Oct. 25 2022, uS Patent 11,482,327.

[9] Kuru, K. et al. (2023). MyPAD: An Intelligent Wearable Medical Device to Treat Incontinence. In: IEEE EMBS International Conference on Data Science and Engineering in Healthcare, Medicine & Biology, 7th – 9th December 2023, Malta.

[10] Ansell, D., Kuru, K., & Sugden, P. (2019). MyPAD: A pre-void alarm device for the treatment of Nocturnal Enuresis (NE). In: North West Bladder Study Day, Royal Manchester Children's Hospital, Post Graduate Education Centre, Manchester, United Kingdom.

[11] Kuru, K., et al. (2019). Transformation to Advanced Mechatronics Systems Within New Industrial Revolution: A Novel Framework in Automation of Everything (AoE). In IEEE Access (Vol. 7, pp. 41395–41415). https://doi.org/10.1109/access.2019.2907809