Chapter 4
The New Frontier of Digital Twins in Next-Gen Wearables for Personalized Health Tracking

A. Ashwini
https://orcid.org/0009-0008-1248-7756
Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, India

G. Santhiya
https://orcid.org/0009-0000-0494-8163
SRM Valliammai Engineering College, India

S. Balasubramaniam
https://orcid.org/0000-0003-1371-3088
Kerala University of Digital Sciences, Innovation and Technology, India

ABSTRACT

Next-generation wearable technologies and digital twins are the two ingredients that make the field of individual health monitoring innovation. Digital twins are virtual representations of people, which assimilate data from wearable devices with biometric data and use analytic and machine learning tools to produce models of human health that change in real-time. The biomechanical equivalents of these variables help in enhancing the examination of cyclers' physiological alterations in a way that creates more compelling proposals for patient-oriented medical

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treatments. By integrating this data with digital twin models, healthcare providers can simulate scenarios, predict potential health risks, and tailor treatment plans to the unique needs of each patient. As the integration of digital twins with wearable technologies continues to evolve, it promises to unlock new frontiers in personalized health tracking, revolutionizing the way individuals and clinicians manage health and wellness.

1 INTRODUCTION TO HEALTHCARE WEARABLES

Healthcare wearables are a revolutionary feature in contemporary healthcare systems within which technology is combined with medical supervision aspects. Some of these devices are intended for collecting, processing, and occasionally transmitting some data related to the health status of the device's user, providing the user with real-time information concerning his/her key physiological and behavioural parameters. Whether it's recording workouts or tracking diseases, devices are changing how people and caring organizations look at health. Its skill to routinely track such features as pulse, moving, and sleeping capacities helps the consumer to manage his/her health effectively (Smuck et al., 2021). Indeed, there has come significant advancement in the health care wearables, moving from simple step counters to multifunctional gadgets with superior biometric capabilities. Initially, wearables were primarily geared towards capturing movement, and they were not very informative. Presently, there exist smart watches, biosensors, and even implantable technologies that can regularly monitor complicated health indices like blood oxygen level, glucose level, and ECG, among other indices (Heidel & Hagist, 2020). The advancement in their usefulness has been made by coupling machine learning algorithms with the cloud-based platforms, which facilitates prediction and personalized health advice.

In that regard, health care wearables are holding the most important values because they are tools for preventive health care. Since this data about the health state of a person is collected in intervals, the devices will be able to recognize deviations from normal statuses. This will encourage users to receive appropriate medical care on time (Iqbal et al., 2021). For instance, devices that record heart rhythm can identify atrial fibrillation, a situation that wouldn't present symptoms until scheduled health checkups. Likewise, other diabetes care devices that are used to monitor glucose levels in more detail and continuously enhance patients' ability to control their condition and thereby decrease their likelihood of experiencing complications. These capabilities do not only enhance the lives of the people but also put a lesser burden on over-extended health organizations and hospitals.