Chapter 11
Holistic IoT Framework for Timely Detection of Cardiovascular Diseases

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ABSTRACT

The chapter delves into the innovative intersection of internet of things healthcare to address the pressing global challenge of cardiovascular diseases. This emerges as a sophisticated and user-centric framework designed for early identification and management of cardiovascular conditions. The chapter provides a comprehensive exploration showcasing the integration of wearable devices, health monitoring sensors, and cloud computing to facilitate real-time data collection and analysis. The author presents a framework that employs advanced data analytics and machine learning algorithms, enabling predictive modeling for early detection of cardiovascular risk factors. Case studies demonstrate the tangible success in early disease identification. This chapter fosters an interconnected health ecosystem, ensuring seamless communication between devices and healthcare providers. The user-centric approach is emphasized through intuitive interfaces, feedback loops, and proactive health management features.

1. INTRODUCTION

Cardiovascular diseases or CVDs (World Health Organization: CVDs, 2021) are a major danger to both human health and global healthcare systems, and they have become an unparalleled global health burden. Heart failure, valvular heart diseases, peripheral artery diseases, coronary artery disease, and heart failure are examples of CVDs, which are characterized by conditions affecting the heart and blood arteries. According to the World Health Organization (WHO), cardiovascular diseases (CVDs) account for 17.9 million deaths worldwide each year (World Health Organization, 2023). The incidence of cardiovascular illnesses is rising alarmingly, with several contributing factors such as sedentary lifestyles, unhealthy

eating habits, tobacco use, and an aging population. These illnesses place a heavy financial strain on healthcare systems in addition to making a substantial contribution to the death rate.

The expenses associated with treating and maintaining cardiovascular diseases go beyond direct medical costs; they also include indirect costs such as lost productivity and reduced quality of life for those who are impacted. Both developed and developing countries are struggling to manage the rising cost of CVDs. Although these illnesses have historically been linked to wealthy communities, they are increasingly spreading to areas with changing socioeconomic environments. This change can be linked to urbanization, the spread of unhealthy lifestyles around the world, and an increase in risk factors including obesity, high blood pressure, and raised cholesterol. The Asia-Pacific area serves as one prime illustration of this global epidemic of cardiovascular disorders as per D. Zhou (2021). This area was formerly known for having a lower frequency of CVDs, but instances are currently significantly increasing.

An alarming rise in hypertension, a key risk factor for cardiovascular events, has been attributed to rapid urbanization, adoption of Western eating habits, and lifestyle modifications. Effective preventative strategies are desperately needed, as evidenced by the growing rates of CVD-related morbidity and death in nations like China and India as per Faghy et al. (2023). The combination of infectious illnesses and inadequate healthcare infrastructure in Africa increases the burden of cardiovascular disorders suggested by Minja et al. (2022). Healthcare systems in the area have a special difficulty because of the interaction between non-communicable illnesses like CVDs and infectious diseases like HIV/AIDS and TB. These conditions demonstrate how intricate and varied the worldwide epidemic of cardiovascular disease is.

Cardiovascular disorders influence more than only death; they also influence the quality of life of individuals who suffer from them. Long-term effects that survivors frequently deal with include diminished productivity, incapacity, and heightened susceptibility to repeated cardiovascular attacks. This emphasizes how important it is to move away from traditional treatment methods and toward proactive tactics centered on early detection and prevention. Internet of Things-based smart frameworks have the potential to become a shining example of innovation and revolutionary healthcare in response to the rising worldwide burden of cardiovascular illnesses as per Nancy et al. (2022). By utilizing the Internet of Things (IoT) to proactively address the issues posed by cardiovascular diseases, such application models would be at the vanguard of a technological revolution as suggested by S. Dami (2022). Advanced sensor-equipped wearables are the first line of defense, continually gathering users' essential health data by Bayoumy et al. (2021). Modern machine learning techniques are used to analyze the data in real time on these devices via seamless communication with the cloud infrastructure. By using patterns and trends in the data obtained, these devices can forecast possible cardiovascular risks in addition to monitoring the user's present state of health.

The creation of a connected health ecosystem and the seamless functioning of communication between medical equipment and providers have benefited greatly from the work done in this chapter. The user-centric approach is evident in features like feedback loops, proactive health management, and user-friendly interfaces. Clinical validation and trials, which verify the framework's efficacy in real-world applications, offer statistical proof.

The increasing prevalence of cardiovascular illnesses worldwide necessitates a paradigm change in healthcare approaches. Innovative and all-encompassing strategies that make use of IoT technological improvements are needed to tackle this dilemma. The creation and implementation of PulseGuard, an Internet of Things-based Smart Framework intended to usher in a new era of early detection and treatment of cardiovascular disorders, will be covered in detail in the parts that follow in this chapter.

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