

Early Screening and Monitoring of Heart Diseases Based on the Fusion of Electrical and Mechanical Sensors: (HEART)

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Abstract

Cardiovascular diseases (CVDs) are the leading cause of death worldwide. In Kuwait, coronary heart disease is the major cause of mortality (30% of deaths) and CVDs are estimated to cause 46.0% of all mortalities. Adequate knowledge about CVD risk factors among individuals will help decrease their risk since many risk factors are adjustable and thus if the disease is screened and detected early, its progression can be controlled and thus prevent death. It is well-known that the detection of structural CVD depends highly on the ability of the physician to listen to cardiac murmurs, phonocardiogram (PCG) and rhythmic CVD on the electrocardiogram (ECG), before the patient is referred to a specialized ward for further investigations (imaging), which can be costly. Nevertheless, current research on low-cost devices has mainly focused on using one signal modality creating a gap in methods for early screening of CVDs. Thus, the overarching aim of this project is to initially design a world-first wearable system for early detection and monitoring of CVDs (HEART) using multiple PCG and ECG sensors coupled with advanced detection algorithms. The scientific method consists of a software part, which focuses on a hybrid approach that combines classical machine learning, deep learning, and mathematical modeling. The hardware part uses a user co-creation approach to assess the system usability and acceptance that will guide the creation of the design. The expected outcome of the project is the delivery of robust and reliable methods for CVD screening, detection, and monitoring together with circuit design and sensor identification. We expect that impact activities with users and stakeholders will help increase awareness for the benefit of the general population and public health with long-term reduction in cost.