ABSTRACT
A SMARTPHONE-BASED CARDIAC HEALTH MONITORING SYSTEM FOR HYPERTENSION

Kazi Shafiul Alam

Marquette University, 2024

Hypertension is the primary modifiable risk factor affecting global health across all causes. It is responsible for developing serious health concerns, including Cardiovascular diseases (CVD), the number one cause of death worldwide. More than half of individuals with hypertension do not know about their condition, and a substantial portion of those who are aware do not get the appropriate treatment. However, effectively managing hypertension has the potential to reduce the global burden of disease and mortality. Monitoring hypertension and cardiovascular health at home or in the office often requires specialized equipment or wearable devices, which can be uncomfortable, require specific skills, or involve significant expenses.

As mobile devices have become integral to our daily lives, remote monitoring has emerged as a practical solution to address this challenge. It offers a high-quality health diagnostic tool that is accessible to everyone. This work introduces a smartphone-based cardiac health monitor using face video without the need for any external setup. The development of a smartphone-based system provides a robust and cost-effective solution to address rising healthcare costs and improve the overall management of heart conditions, particularly for individuals with hypertension.

This dissertation focuses on developing a contactless framework to measure Heart Rate (HR), Heart Rate Variability (HRV), and Blood Pressure (BP) using 10-second face videos captured with a phone camera. The framework has been evaluated by collecting data from participants at Marquette University under an approved Institutional Review Board (IRB). Additionally, this dissertation proposes a novel framework to detect Atrial Fibrillation (AF) from Photoplethysmography (PPG) signals using Natural Language Processing (NLP) techniques.