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Ph.D. DISSERTATION DEFENSE

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Title: Enhancing Remote Health Monitoring System with a Focus on Wearable Technology and Machine Learning

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ABSTRACT

The widespread use of wearable sensing devices and the Internet of Things (IoT) has made remote health monitoring a vital component of the healthcare system. Remote health monitoring involves the continuous collection and analysis of physiological data through wearable devices and connected technologies, enabling real-time assessment and management of health conditions outside traditional clinical settings. However, the effective application of wearable devices in remote health monitoring faces several challenges. The primary challenges include the need for advanced analytical methods to effectively interpret physiological parameters, addressing usability and concerns to enhance user acceptance, and maintaining data integrity across various scenarios. This research aims to apply system engineering principles to address the current challenges and improve healthcare delivery of the remote health monitoring system.

In this dissertation, I employed statistical methods, advanced machine-learning algorithms, and human-subject experimentation to unfold key research questions regarding how physiological data collected by the wearable devices indicate health status, how wearable adoption influences acceptance of telehealth, and how wearable data should be utilized for accurate health assessment. My approach aims to systematically integrate multimodal data, user-centered design, advanced analytical methods, and data integrity assessment, potentially transforming wearable technology into a more reliable and effective tool for healthcare and improving user acceptance of remote health monitoring.

The findings of this research indicate that physiological data, such as heart rate, can provide some indication but cannot alone reliably indicate self-reported stress level and should be combined with comprehensive physiological and psychological measures for a more accurate assessment. This novel perspective enhances our understanding of predictive capability for wearable data using

conventional statistical methods. Additionally, by addressing usability and comfort issues, particularly in the aging population, I aim to understand the influential factors of the acceptance rates for this user group of interest and facilitate the broader adoption of remote health monitoring technologies.

Furthermore, I reviewed the advanced machine-learning algorithms for disease detection and health monitoring, providing insights into enhancing the remote health monitoring system. Applying the knowledge of machine-learning algorithms, I extend this research to examine the factors that affect data integrity in wearable devices, aiming to develop systems that ensure accurate and reliable health monitoring. By applying the systems engineering framework to the design and deployment of remote health monitoring, this research provides invaluable insights for advancing healthcare delivery through a more effective, reliable, and user-friendly remote health monitoring system.