Thesis Project Portfolio

Pulse Waveform Analysis Instrument for Cardiovascular Heart Disease Assessment

(Technical Report)

Investigation of Medical Device Pricing and its impact on Accessible and Equal Care in different countries

(STS Research Paper)

An Undergraduate Thesis

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Bachelor of Science, School of Engineering

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Sociotechnical Synthesis

Introduction:

The focus of the technical and STS research paper revolves around the need for non-invasive and accessible medical devices to reduce healthcare disparities within the medical field. The goal of the technical project is to develop a non-invasive, safe, and accessible way to measure PWV with minimal error in order to assess people's risk of death from heart disease and encourage early prevention and treatment.The goal of the STS research paper is to investigate the role of social groups and their needs in developing medical technologies and their pricings in culturally different countries . As the technical project's goal is on the development of a medical device which aims to act as a diagnostic tool for heart disease, the STS research paper will look into how different countries would use this technology and analyze its accessibility and impact.

Technical Project:

In the technical project, the goal was to improve upon a prototype of a pulse waveform analysis instrument that is able to non-invasively and accurately measure peripheral pulse waveform (PWV) and calculate a patient's risk of death. Collaborating with Dr. Mazimba, Cardiologist at the University of Virginia hospital, and Dr. Hossack, Biomedical Engineering professor, I developed a tool for an accurate measurement of pulse waveform through photoplethysmography (PPG). The device uses an Arduino-linked pulse oximeter to measure a person's peripheral PWV. I worked on refining the user interface of the device by integrating a new TFT LCD module and implementing the graphic user interface for it. With this, there was real-time graphing of both the pulse waveform and the electrocardiogram for physician viewing when they are monitoring their patients. Additionally, I added additional features that would be required as the prototype would no longer be connected to a laptop. Features such as cordless power and data storage were added to make the prototype more independent and complete. To

verify the accuracy and reliability of the device, there will be PWV data collection of patients before and after cardiac procedures in the University of Virginia hospital. This data would be used in the future as well to enhance the training model to detect cardiac risks and to support the development of a transfer function to transform the peripheral waveform. Overall, making the device intuitive for residents and others to use would increase accessibility of cardiac health detection by lowering the skills needed to use.

STS Research Paper:

In my STS research paper, I looked into the comparison of accessibility of medical devices in two different countries, USA and Japan, based on the pricing of these technologies. With the roles of different cultures and social groups in each country, I wanted to investigate how these stakeholders shape the role of magnetic resonance imaging (MRI) in particular and their development and pricing. Both countries' systems have their strengths and weaknesses in terms of access to healthcare, affordability, and quality of care. However, the use of MRI technology has undoubtedly played a crucial role in improving patient outcomes and advancing medical knowledge in both countries. This research emphasizes that as technology continues to evolve, it will be important for healthcare systems around the world to consider the social and cultural factors that shape the development and use of such technologies, in order to maximize their potential benefits for patients and society as a whole.