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According to a report by the World Health Organization, out of approximately 17 million deaths caused by non-communicable diseases in 2019, about 6.46 million, accounting for 38% were due to cardiovascular-related conditions such as hypertension, heart failure, and coronary artery disease (World Health Organization, 2021). Therefore, heart rate measurement plays a crucial role in monitoring and diagnosing symptoms related to the cardiovascular system.

This study investigates the reliability of measuring heart rate by applying image photoplethysmography (iPPG) to analysing facial video at different frame rates. iPPG is a contactless method that can measure the heart rate by analysing subtle colour changes on the face collected by video. By doing this, it can offer a promising alternative to health monitoring for individuals with sensitive skin (Shukla & Das, 2022) or in a COVID-19 situation where physical contact is limited.

Facial videos were captured using a GoPro Hero3+ camera with a resolution of 1920×1440 pixels at three different frame rates: 24 fps, 25 fps, and 48 fps. After that, the videos were processed using MATLAB 2024b to extract the heart rate signal using a custom-designed algorithm. In the next step, the heart rate results were displayed across three color channels: red, blue, and green. Each test was calculated and validated against a pulse oximeter to evaluate the accuracy of the measured heart rate. All trials were conducted on a single subject.

The findings indicated that the green channel is the most effective in videos with a resolution of 1920x1440 at 24 fps. In contrast, the videos with resolution 1920x1440 at 48 fps show that the red channel's values are closest to the measured value. Conversely, the video at a resolution of 1920x1440 and 35 fps shows no significant differences among the three colour channels.

This research supports the development of more accessible and convenient heart rate monitoring methods, particularly for participants who have sensitive skin and long-distance situations. By enhancing the processing algorithm, iPPG can be beneficial to enhance remote health monitoring and wellbeing applications.

References
World Health Organization. (2021, June 11). *Cardiovascular diseases (CVDs)*. WHO. https://www.who.int/news-room/fact-sheets/detail/cardiovascular-diseases-%28cvds%29

Shukla, S., & Das, D. (2022, December). *IoT based non-invasive vital signs monitoring in neonatal intensive care unit (NICU)* [Paper presentation]. 2022 IEEE International Women in Engineering Conference on Electrical and Computer Engineering (WIECONECE), India. https://doi.org/10.1109/WIECON-ECE57977.2022.10150954