VRIJE UNIVERSITEIT BRUSSEL

The faculty of Engineering of the Vrije Universiteit Brussel invites you to attend the public defense leading to the degree of

DOCTOR OF ENGINEERING SCIENCES

of **Ángel Solé Morillo**

The public defense will take place on **Thursday 20th February 2025 at 4pm** in room **D.2.01** (Building D, VUB Main Campus)

To join the digital defense, please click here
Meeting ID: 351 750 838 511
Passcode: aj6DW9jv

M3-PPG: TOWARDS NOVEL (PERSONALIZED) PHOTOPLETHYSMOGRAPHY SYSTEMS THROUGH THE UNDERSTANING OF KEY INFLUENCING FACTORS

BOARD OF EXAMINERS

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Abstract of the PhD research

Photoplethysmography (PPG) is a low-cost technique that allows for extracting physiological parameters, such as heart rate or blood oxygen saturation, through light interactions with the skin. PPG has been present in clinical practice as the technology behind pulse oximeters since the 1980s. With the proliferation of health wearables equipped with PPG sensors in the last 15 years and the advancement in PPG applications beyond pulse oximetry, a new perspective has arisen, with PPG having the potential to tackle some key societal and health issues of the 21st century.

Despite its widespread adoption, PPG remains susceptible to various factors that can compromise the accuracy of the physiological measurements. Understanding these influences individually can improve and expand the use and applications of PPG, ultimately enabling personalized health monitoring.

This research first proposes a theoretical framework, which describes key hardware and software improvements that can enable robust and personalized physiological monitoring using PPG technology. Next, an analysis of the impact of the instrumentation on the PPG signal is presented.

In addition, the impact of skin tone on the PPG signal is evaluated. Melanin, another PPG influencing factor whose content in the skin gives rise to different skin colors, is measured with two prototypes in a pilot study. This contributes to addressing the oxygen saturation overestimation in pulse oximeters for users with darker skin tones.

The final part integrates all previous research findings into a prototype designed for continuous vital sign monitoring at the chest, whose performance was validated through an initial pilot study with healthy participants. This work also analyses how regulations impact this prototype's possible road to market as a medical device in Europe and the U.S.