

## TOPIC OF A COMPETITION PROMOTING STUDENT ENGAGEMENT IN SCIENTIFIC ACTIVITIES

Topic: Wearable Biomedical Photonic Sensors for Continuous Health Monitoring
Goal: To explore optical methods for monitoring vital signs such as heart rate, oxygen levels, and hydration.
Short description (max. 2000 characters):  Wearables increasingly use photonic methods like PPG and NIR spectroscopy for continuous monitoring. Students will review existing devices and their limitations. Using open PPG datasets, they will implement signal processing pipelines to estimate heart rate and oxygen saturation. They will test motion artifact reduction methods and compare accuracy across conditions. Optionally, students can prototype a sensor with Arduino and validate results experimentally.  Tools and Materials: Python/Octave, open PPG datasets (PhysioNet), optional Arduino with MAX30100 sensor.  Desired Background: Biomedical Engineering, Signal Processing, Embedded Systems (optional).  <i>Suitable for a third or fourth -year Bachelor or Master student.</i>  References: - Elgendi, M., et al. (2024). Recommendations for evaluating photoplethysmography-based algorithms for blood pressure assessment. <i>Communications Medicine</i> . doi:10.1038/s43856-024-00555-2 - Reiss, A., et al. (2019). PPG-DaLiA dataset: PPG and motion data recorded in daily life. Zenodo.
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