

Research Field And Department	Department of Systems Engineering and Automation
Supervisor	Raúl Fernández Matellán
Title of the Work	Physiological Signal Cleaning for Driver-State Studies
<p>Objective: We want to take messy physiological recordings (skin conductance, pulse, heart rate) from real devices and turn them into clean, reliable data. By the end, you'll learn how to:</p> <ul style="list-style-type: none">• Load and line up recordings in time,• Remove noise and electrical interference,• Detect heart beats and other key events,• Compute simple health/attention indicators (HR, HRV, EDA peaks),• Visualize and export results for research. <p>Abstract:</p> <p>We target noise/artifact removal in physiological signals—EDA, PPG, and HR—recorded by real devices. The project designs filtering pipelines (DC removal for slow drifts, band-pass to retain physiologically relevant bands, and notch for mains interference), followed by Kalman filtering for smoothing and state estimation (e.g., instantaneous heart rate from PPG/ECG peaks). We implement robust peak/valley detection to obtain maxima, minima, inter-beat intervals, and HR/HRV series. The goal is to convert raw measurements into clean, stable, and reproducible signals and biomarkers suitable for driver-state studies.</p> <p>Main Tasks to Carry Out:</p> <ul style="list-style-type: none">• Load raw EDA/PPG/HR from devices and align timestamps.• Design and apply DC removal, band-pass, and notch filters per signal.• Implement a Kalman filter/smoother to denoise and track the clean state.• Build peak/valley detection (prominence + refractory rules) to compute IBI, HR, and HRV.• Generate quality metrics (missed/extra peaks, SNR before/after, filter latency).• Visualize raw vs. filtered signals; export cleaned series and biomarkers. <p>References/Bibliography if required</p> <p>A preliminary bibliography is included; an expanded reference list will be supplied at the beginning of their stage.</p> <p>https://youtu.be/mef7bjmK1UI?si=9FShq43hRTW0X_UV https://github.com/emotibit https://ieeexplore.ieee.org/document/9235582 https://youtu.be/mwn8xhgNpFY?si=AMwi8KKvtMSGGy8t https://www.ros.org/</p>	