

Research Field And Department	Department of Systems Engineering and Automation
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Title of the Work	Physiological Signal Cleaning for Driver-State Studies

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:

- 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.

Abstract:
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.

Main Tasks to Carry Out:

- 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/smooth to denoise and track the clean state.
- Build peak/valley detection (prominence + refractory rules) to compute IBI, HR, and HRV.
- Generate quality metrics (missed/extraneous peaks, SNR before/after, filter latency).
- Visualize raw vs. filtered signals; export cleaned series and biomarkers.

References/Bibliography if required
A preliminary bibliography is included; an expanded reference list will be supplied at the beginning of their stage.

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/>