

Wearable Sensors to Evaluate Stress and Enhanced Assisted Rescue Response

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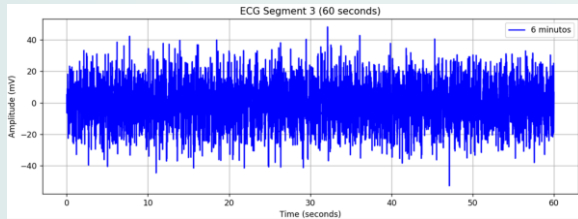
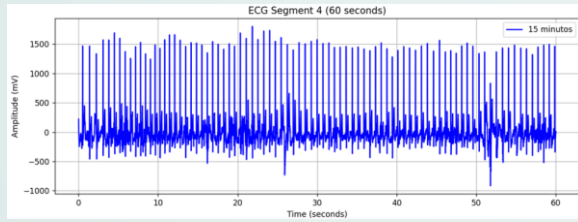
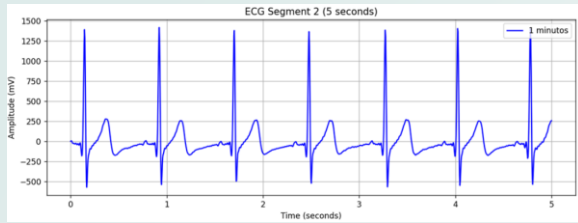
Field Testing

- Field testing involved wearable devices used by firefighter volunteers during real-life operations
- 15 firefighters have participated so far, with plans to expand to 55 volunteers
- Data collection includes ECG signals, movement metrics and daily activity surveys
- Surveys assess effort, fatigue and stress levels to correlate with physiological data
- Controlled tests done at LEIF simulated firefighting scenarios, including hose dragging and branch burning, to analyze signal behavior under varying conditions



Figure 3: Field tests done at LEIF

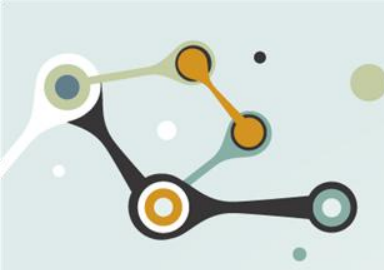
Preliminary Difficulties



Figures 4, 5 & 6: Perfect signal examples with a duration of 5 seconds (upper) and 1 minute (center) and an example of a static signal (lower)

- Most data showed signal acceptance rates between 60–95%, demonstrating general reliability
- A loose-fitting device worn by one volunteer caused signal quality to drop below 30%
- The tightness of the device was confirmed as a critical factor for ensuring reliable good-quality signal acquisition and minimizing interference
- There were also low-amplitude signals, with R waves measuring $\sim 200 \mu\text{V}$ instead of the expected $\sim 1500 \mu\text{V}$, possibly due to sweat or skin hair
- A medical expert emphasized that the shape of the PQRST waves is more important than their amplitude for stress detection
- These findings highlight the need for improved device fit and further refinement of analysis methods to ensure reliable results under field conditions

Work Plan



Task	2024			2025								
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Bibliographic Research	█											
Thesis Writing			█	█						█		
Prototype Development	█			█								
Field Testing	█			█								
Data Processing		█		█								
System Implementation								█				

Next Tasks:

- Analyze signals resulting from LEIF field tests
- Implement HRV and Fourier Transform
- Acquire more data for prototype comparison (e.g. Fabric vs Foam)





Thank You!