

Problem & Motivation

Pet owners often fail to detect early signs of illness in dogs. No low-cost, non-invasive wearable currently measures multiple canine vitals simultaneously in real time.

Proposed Solution

A non-invasive wearable vest integrating four biosensors with automatic tightening, an onboard microcontroller, and a mobile app for real-time vital sign monitoring and anomaly alerts.

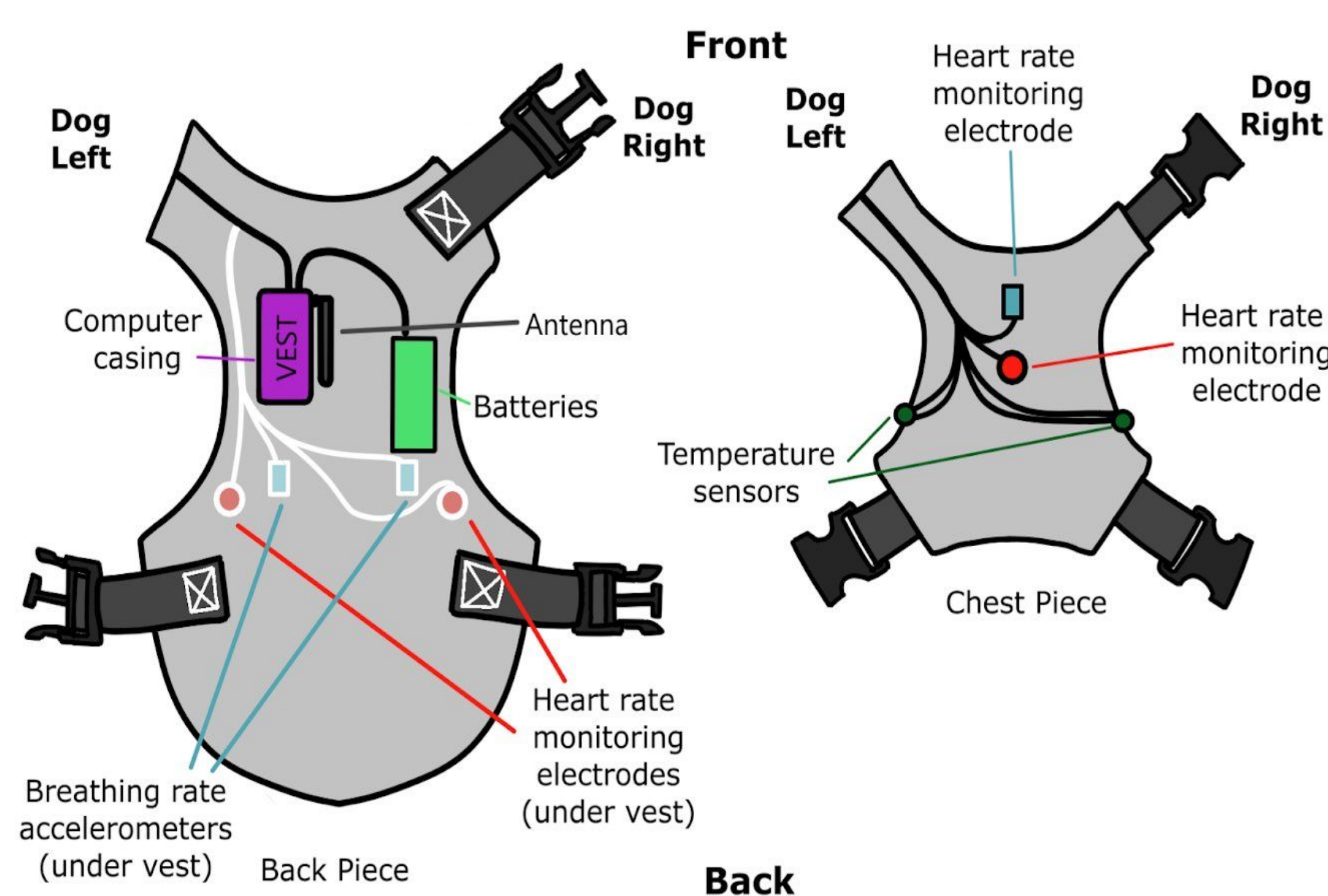


Figure 1 - Vest Prototype Sketch

To ensure the comfort, stability, and protection of the dog, ripstop nylon, polyurethane foam, and stretch mesh were selected for their optimal balance of cost-effectiveness, durability, flexibility, breathability, and waterproofing.

Sensors Validation & Processing

- **Accelerometer** - tracking movement
- **Thermistor** - estimating core body temperature
- **Stretch Sensor** - measuring breathing rate
- **ECG** - measuring heart rate and heart rate Variability

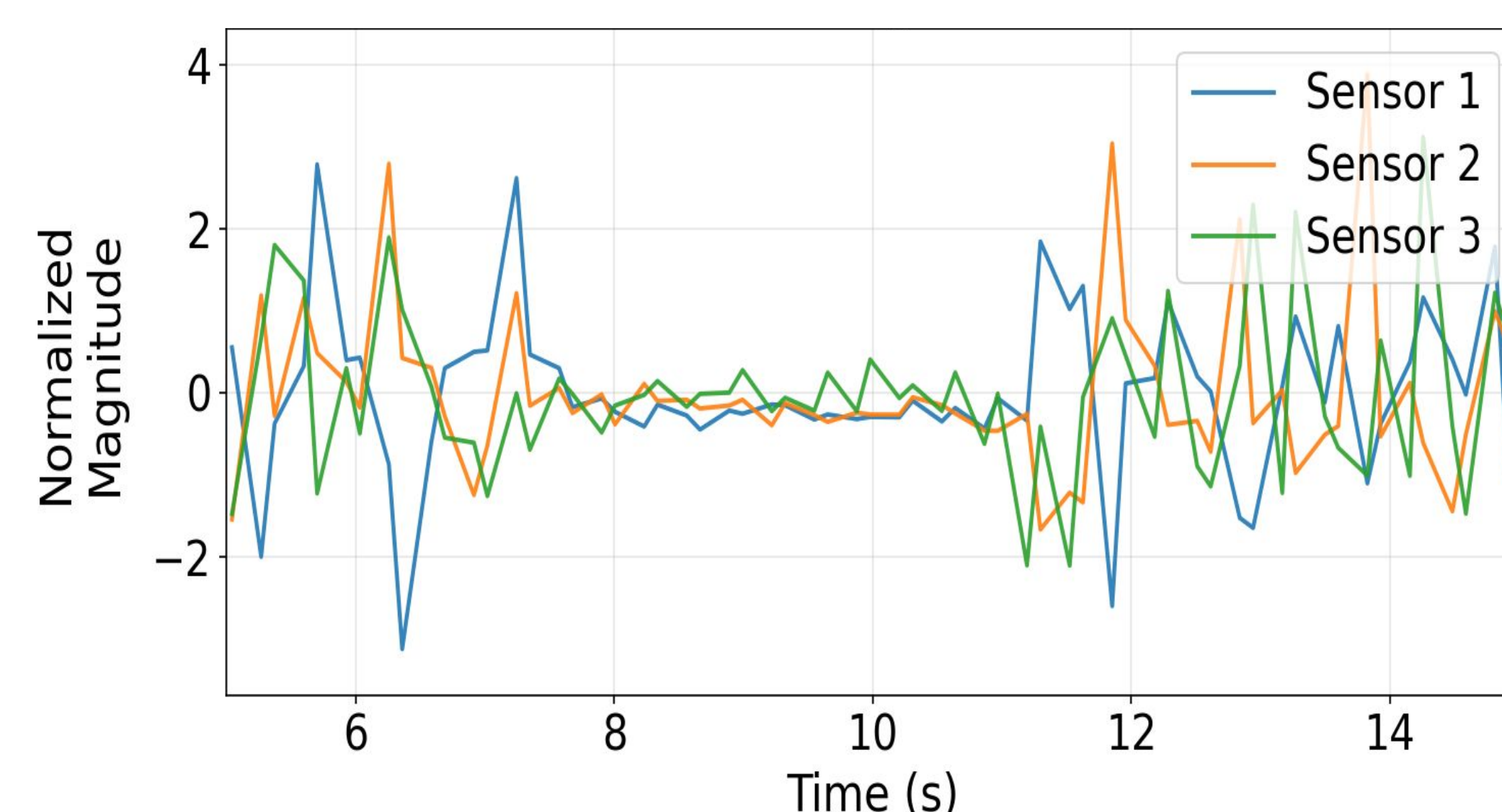


Figure 3 - Activity Graph sample (Accelerometers). Peaks show movement, minor peaks show no movement.

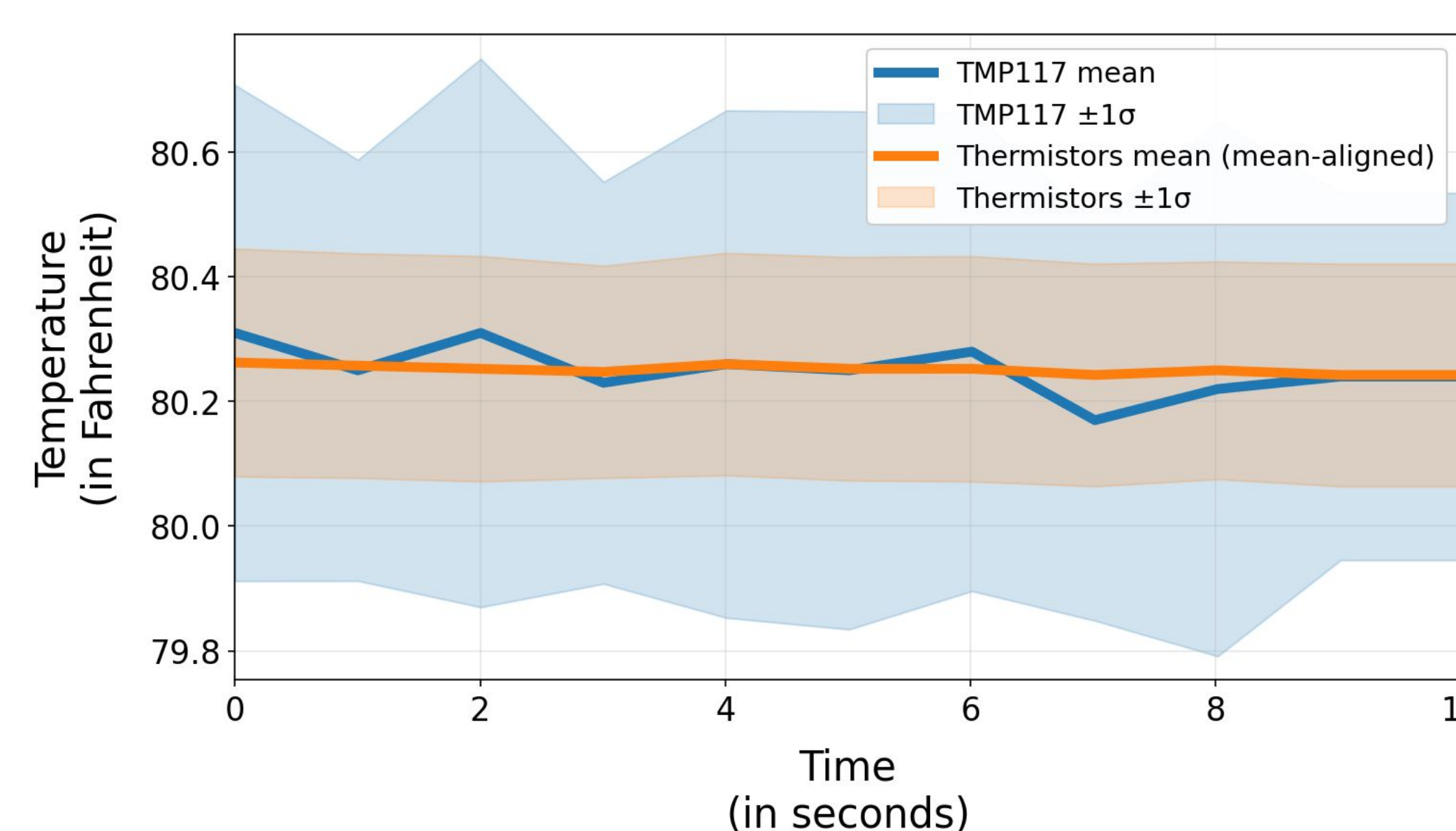


Figure 4 - Mean Temperature of Thermistor & TMP 117 for first 10 seconds with offset of 3.9 degrees.

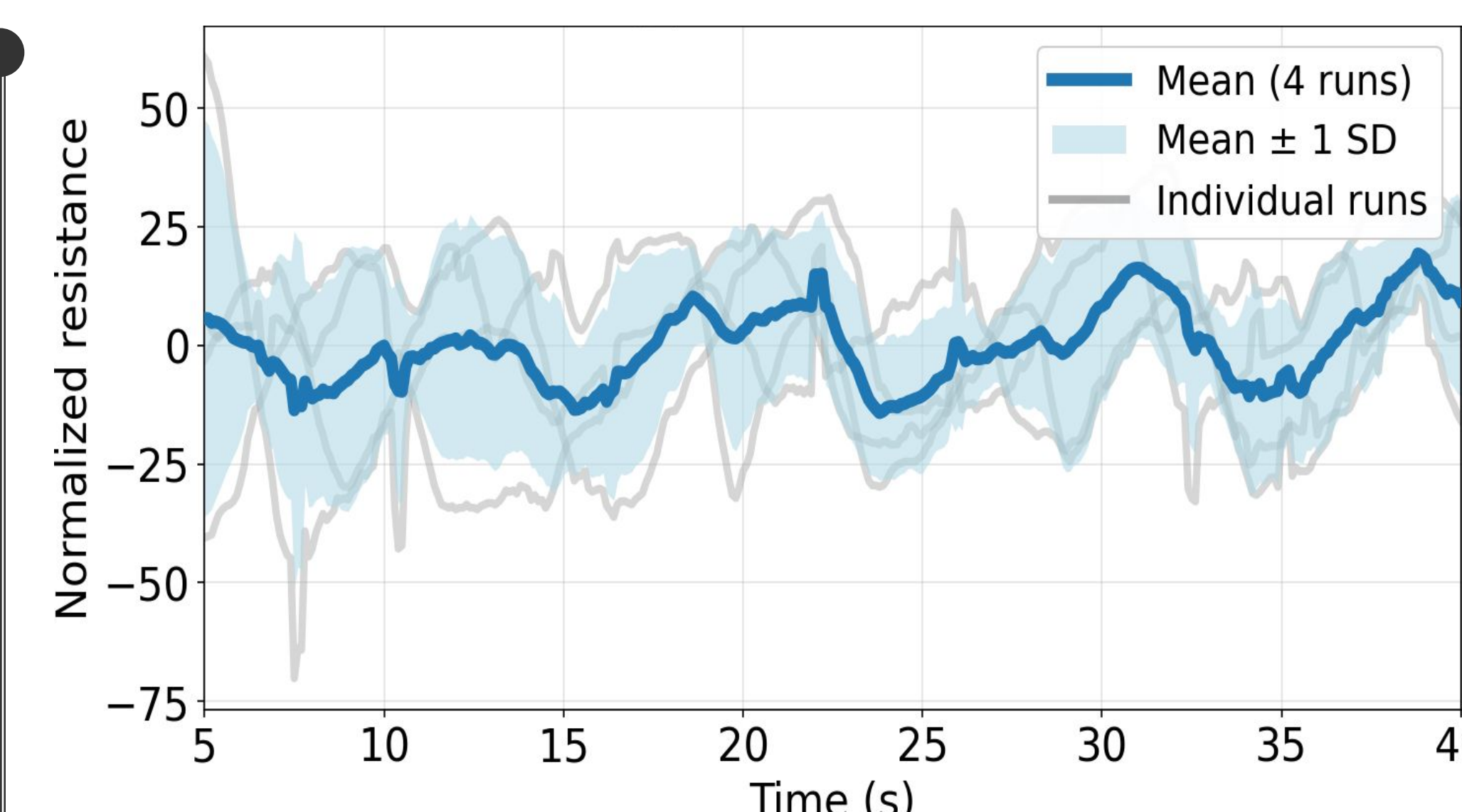


Figure 5 - Stretch Sensor Mean Resistance with 1 standard deviation between 5 - 40 seconds. First 5 seconds removed due to calibration.

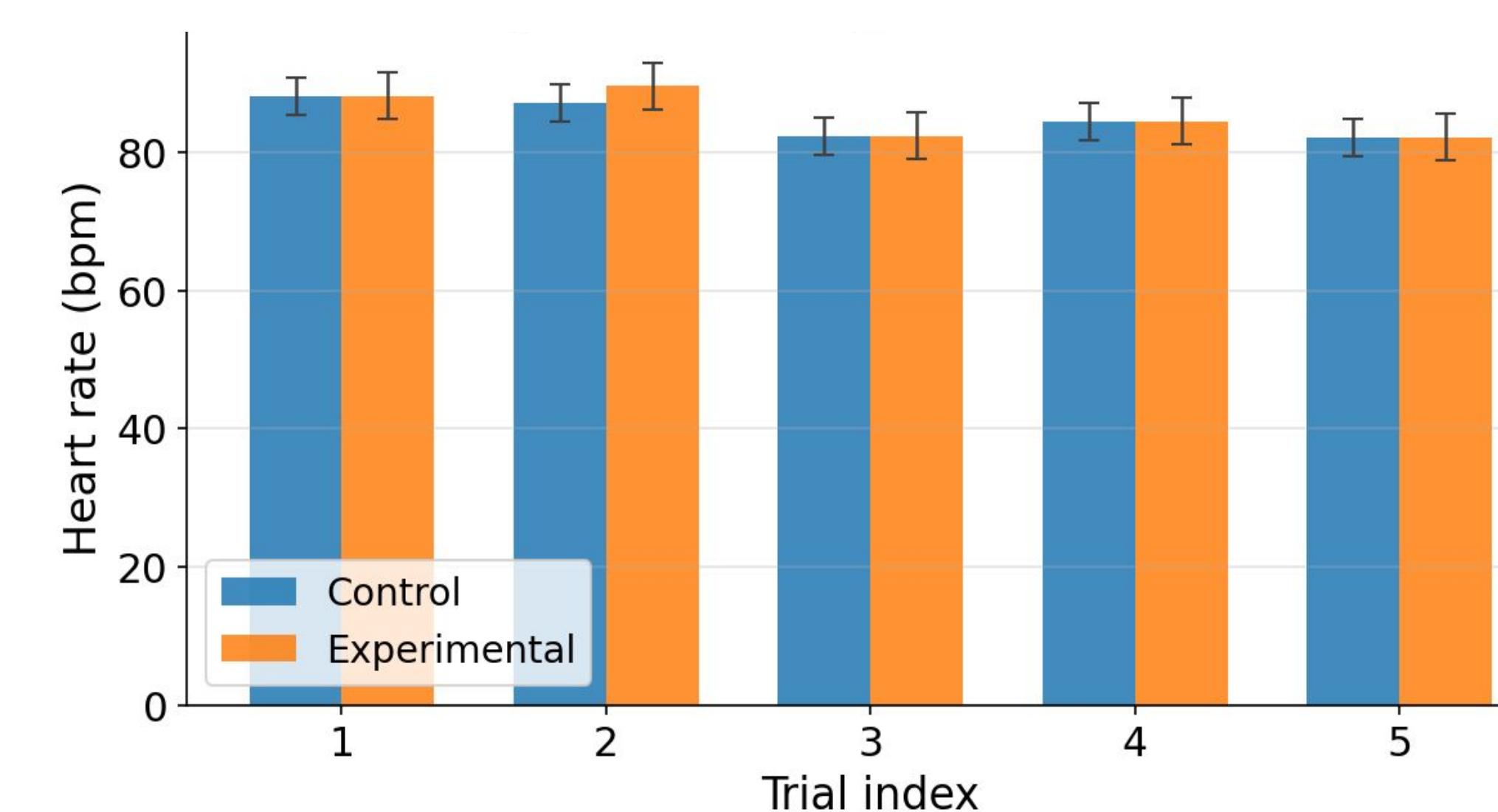


Figure 6 - Average Heart Rate (Experimental Vs. Control). Across all trials Control mean 84.88 BPM \pm 2.73 BPM and the experimental was 85.37BPM \pm 3.39 BPM

Software Architecture

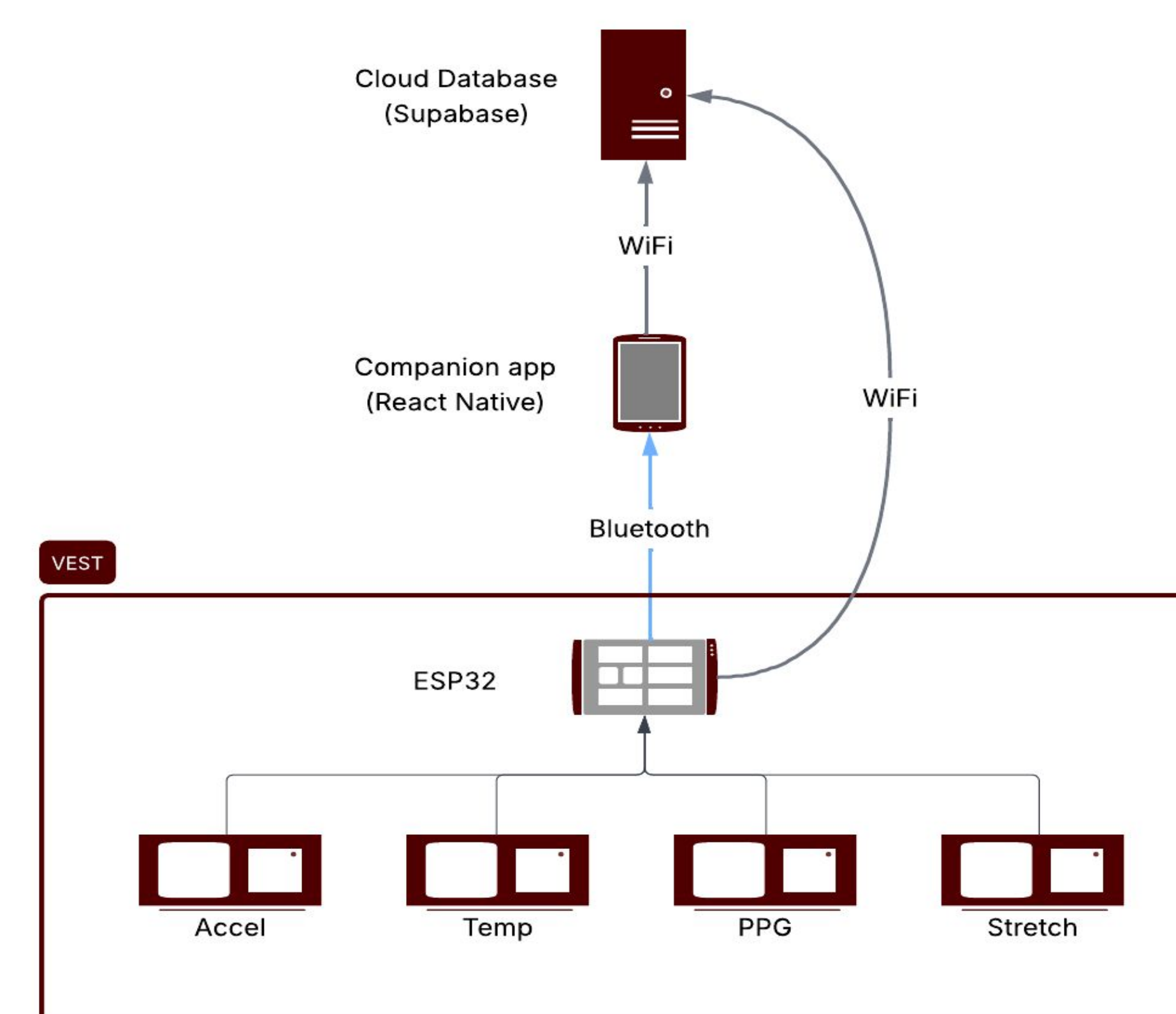


Figure 7 - System Architecture for dog vest to server communication

Machine Learning

The LightGBM model achieves 81% accuracy on 20,000 simulated canine health samples, with intentional bias toward false positives to minimize missed emergencies. Precision and recall vary by state: "Healthy" is easiest to classify (93% precision, 82% recall), while "Concerning" is more challenging (60% precision, 79% recall).

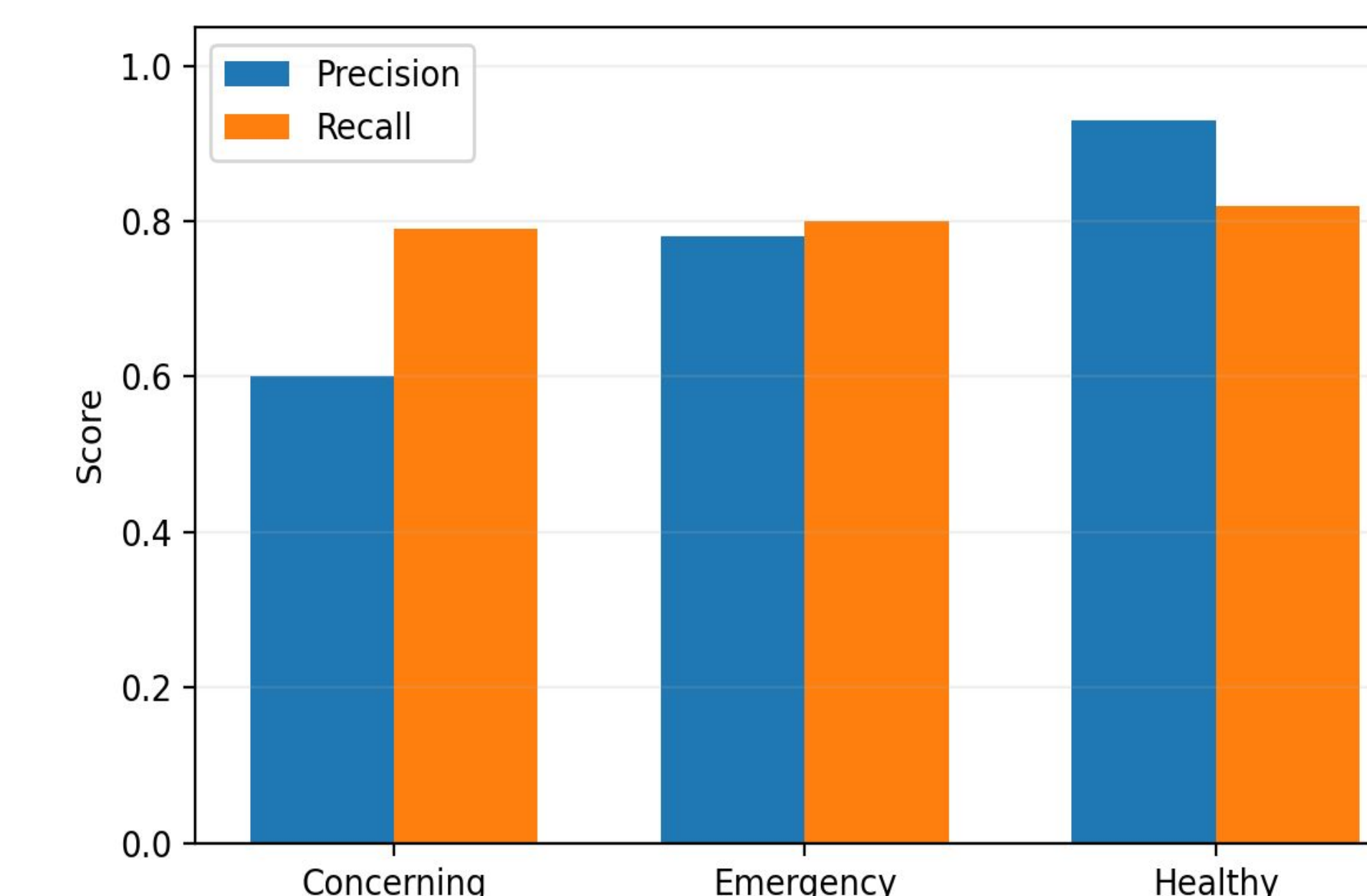


Figure 8 - Random Forest Precision & Recall of simulated data

Conclusion

VEST proves a concept of a low-cost (~\$92 - \$100) non-invasive wearable can reliably monitor canine vitals via remotely and classify health states with 81% accuracy using simulated data.

Future Work

Future work will expand sensing capabilities, breed compatibility, app release, and live animal testing toward a veterinary-grade monitoring solution.

Scan the QR code to learn more about VEST.

