

# Appendix C — Track Records of Computing Power Usage and Team

## AuraSense Limited | AISS Application 2026

### 1. Track Record of Computing Power Usage

#### Current Development Environment

AuraSense has developed and benchmarked the entire SFSVC engine using GitHub Codespaces (cloud VM — 4-core x86-64 with AVX2, 16 GB RAM, no GPU). Despite the limited environment, the team achieved production-level performance metrics, demonstrating efficient use of computing resources and strong optimisation skills.

#### Benchmark Results (Codespaces VM, No GPU)

METRIC	RESULT	NOTES
Frames Processed	1,127	Full demo.mp4 @ 30fps
Throughput	125.5 fps	6 processing lanes
P50 Latency	0.399 ms	End-to-end control path
P95 Latency	0.559 ms	Stable across runs
P99 Latency	0.637 ms	
Spike Events	6,840,849	Deterministic output
Sparsity	93.76%	Consistent across 2 runs
Run Variance	<2.7% P95	High reproducibility

## Optimisation History (Demonstrating Efficient Resource Use)

PHASE	OPTIMISATION	LATENCY IMPACT	METHOD
Baseline	Scalar C++ implementation	P95: ~50 ms	Naive per-pixel loop
Phase 1	AVX2 SIMD frame copy	P95: -5%	256-bit register memcpy
Phase 2	AVX2 delta spike computation	P95: -40%	32 pixels per SIMD op
Phase 3	Fixed-point SIMD resize	P95: -10%	Eliminated floating-point resize
Phase 4	Lock-free queue + multi-lane	P95: ~0.56 ms	Concurrent 6-lane pipeline

## Why GPU Computing Is Now Needed

The current engine operates entirely on CPU with hand-tuned parameters. To advance to production-grade with learned models, GPU computing is essential for:

1. **Training neuromorphic spike encoders** — temporal convolutional models over 1,000+ frame sequences, batch size 32–64, mixed precision (FP16/FP32)
2. **Fine-tuning crack perception models** — CNN-based models on crack datasets (100+ GB)
3. **YOLOv8-nano training** — Object detection model for semantic crack labelling and severity classification
4. **Large-scale simulation sweeps** — 100+ parameter combinations to validate robustness under varying conditions

Estimated GPU requirement: ~3,600 GPU-hours over 6 months (2 GPU cards).

## 2. Track Record of the Team

### Technical Achievements

ACHIEVEMENT	EVIDENCE
Complete SFSVC C++ engine	20+ source files, 5,000+ lines of production C++
AVX2 SIMD optimisation	<code>compute_delta_spikes_avx2()</code> — 32 pixels per register

ACHIEVEMENT	EVIDENCE
Multi-rate four-lane architecture	Biologically-inspired, from hard-RT control to YOLO semantics
Lock-free concurrent pipeline	<code>lockfree_queue.h</code> — wait-free multi-producer/single-consumer
Python SDK via pybind11	<code>rt_core_pybind.cpp</code> — seamless ML integration
Failsafe subsystem	<code>failsafe.cpp</code> + <code>degraded_mode_policy.cpp</code>
Provisional patent filed	Spike-based neuromorphic video encoding method
Professional website	<a href="http://www.aurasensehk.com">www.aurasensehk.com</a> — live product marketing site
Comprehensive documentation	Datasheet, deployment checklist, pilot onboarding guide

## Codebase Summary (GitHub: AuraSense-SFSVC)

Source Code: 20+ C++/Python files  
 Build System: CMake with AVX2 auto-detection  
 Testing: Automated benchmarks + validation suite  
 Documentation: Technical datasheet, benchmark reports, pilot guides  
 CI/CD: GitHub Actions (planned)

## Key Publications & Recognition

- Research papers in preparation — targeting publication in IEEE/ACM conferences on neuromorphic computing and edge AI as part of this project

## Open Source Engagement

- AuraSense SFSVC repository hosted on GitHub
- Technical documentation and benchmark data publicly available
- Demonstrates transparency and reproducibility of results

---

AuraSense Limited — Demonstrating efficient, world-class R&D output with minimal resources