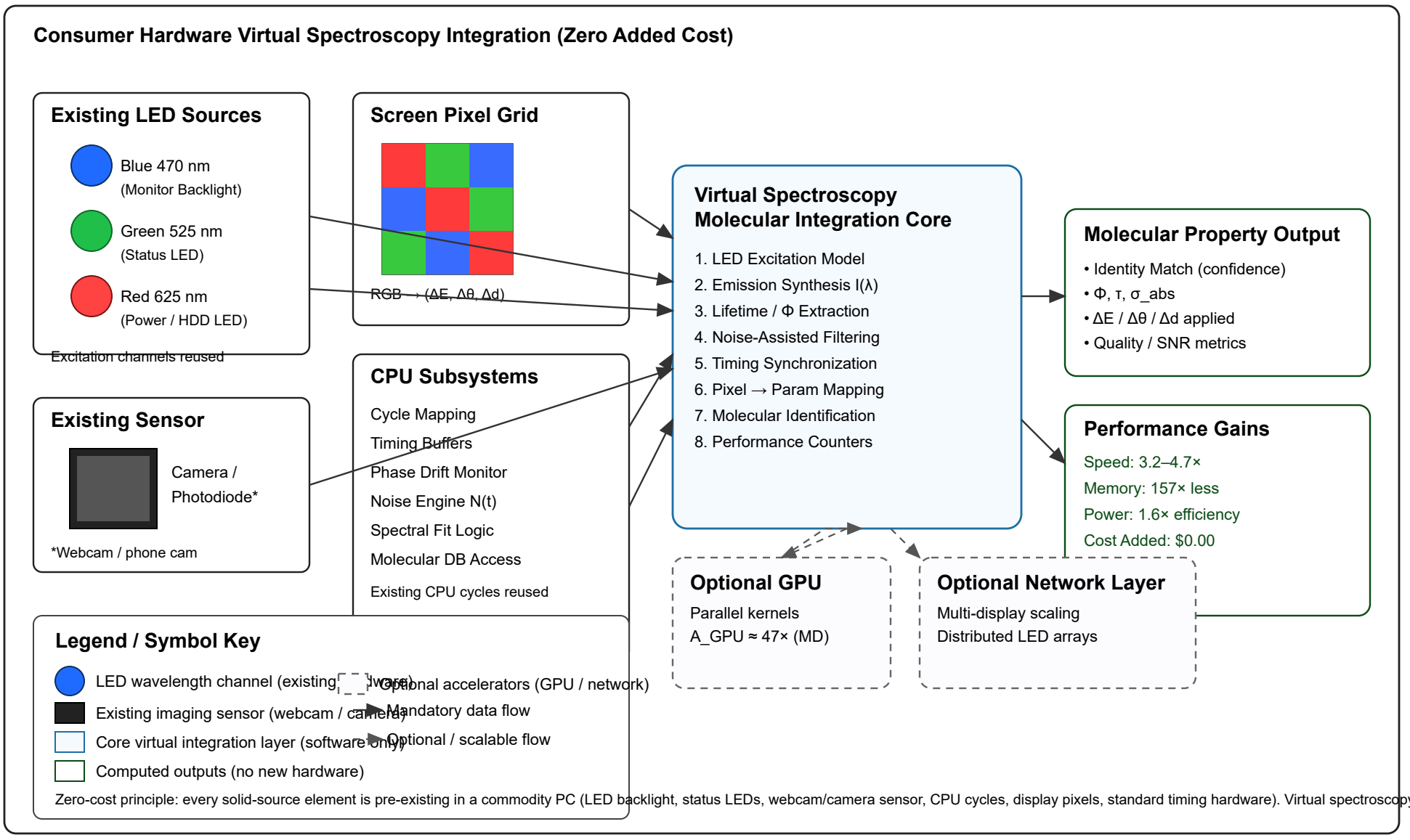
Consumer Hardware Virtual Spectroscopy Integration (Zero Added Cost)
Existing LED Sources
Blue 470 nm
(Monitor Backlight)
Green 525 nm
(Status LED)
Red 625 nm
(Power / HDD LED)
Excitation channels reused
Screen Pixel Grid
RGB → (ΔE, Δθ, Δd)
Existing Sensor
Camera /
Photodiode*
*Webcam / phone cam
CPU Subsystems
Cycle Mapping
Timing Buffers
Phase Drift Monitor
Noise Engine N(t)
Spectral Fit Logic
Molecular DB Access
Existing CPU cycles reused
Virtual Spectroscopy
Molecular Integration Core
1. LED Excitation Model
2. Emission Synthesis I(λ)
3. Lifetime / Φ Extraction
4. Noise-Assisted Filtering
5. Timing Synchronization
6. Pixel → Param Mapping
7. Molecular Identification
8. Performance Counters
Molecular Property Output
• Identity Match (confidence)
• Φ, τ, σ_abs
• ΔE / Δθ / Δd applied
• Quality / SNR metrics
Performance Gains
Speed: 3.2–4.7×
Memory: 157× less
Power: 1.6× efficiency
Cost Added: $0.00
Optional GPU
Parallel kernels
A_GPU ≈ 47× (MD)
Optional Network Layer
Multi-display scaling
Distributed LED arrays
Legend / Symbol Key
LED wavelength channel (existing hardware)
Existing imaging sensor (webcam / camera)
Core virtual integration layer (software only)
Computed outputs (no new hardware)
Optional accelerators (GPU / network)
Mandatory data flow
Optional / scalable flow
Zero-cost principle: every solid-source element is pre-existing in a commodity PC (LED backlight, status LEDs, webcam/camera sensor, CPU cycles, display pixels, standard timing hardware). Virtual spectroscopy