

PERFORMANCE EVALUATION OF SELECTED RASPBERRY PI PLATFORMS FOR PORTABLE AUDIO-VIDEO SURVEILLANCE SYSTEMS

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ABSTRACT

Portable surveillance applications impose conflicting requirements: high video quality demands processing power, extended autonomy requires minimal power consumption, and covert deployment necessitates compact form factors. This paper evaluates three Raspberry Pi platforms to determine optimal configurations for distinct surveillance scenarios.

The study compares Raspberry Pi 5 (quad-core Cortex-A76, 2.4GHz), Raspberry Pi 4B (quad-core Cortex-A72, 1.5GHz), and Raspberry Pi Zero 2W (quad-core Cortex-A53, 1GHz) across metrics relevant to portable surveillance: video encoding performance, power consumption, thermal behavior, physical size, and cost. A common software architecture enables controlled comparison while platform-specific optimizations leverage hardware acceleration capabilities.

Three application scenarios drive the analysis:

- **Scenario A (Stationary High-Quality):** Fixed-position surveillance with AC power, requiring high-resolution video streaming. Pi 5 demonstrates superior encoding performance enabling higher quality or multi-stream applications.
- **Scenario B (Mobile Balanced):** Vehicle-mounted or portable surveillance with limited battery capacity. Pi 4B provides optimal performance-per-watt for battery-powered mobile applications.
- **Scenario C (Covert Extended):** Concealed surveillance prioritizing minimal size and maximum battery life. Pi Zero's compact footprint and low power consumption enables extended autonomous operation in compact enclosures.

Quantitative results include power consumption measurements across operational states, thermal analysis under continuous encoding, battery life calculations for different capacity/platform combinations, and 4G modem compatibility across the platform range. Performance-cost analysis reveals significant advantages for different deployment scenarios.

The findings provide decision criteria for matching Raspberry Pi platforms to surveillance deployment requirements.

Keywords: Raspberry Pi performance, scenario-based design, portable surveillance, power consumption analysis, embedded video systems, application optimization