QpiAI Achieves High-Speed Quantum Error Correction on Superconducting Systems with New Decoder Platform

Custom hardware enables real-time error correction on 64-qubit Kaveri quantum processor, achieving 'significant milestone' for India's National Quantum Mission

BANGALORE, INDIA, March 25, 2026 /EINPresswire.com/ -- QpiAI, a leading developer of integrated AI and quantum solutions for enterprises, today announced a major advance in quantum error correction (QEC), unveiling a high-speed decoder hardware platform that dramatically reduces the time required to detect and correct errors in real time on superconducting quantum processors.

> "
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> *QpiAI Founder and CEO Nagendra Nagaraja, Ph.D*

In research conducted by the company on its 64-qubit Kaveri quantum superconducting processor, the compact decoder hardware, based on a union-find algorithm, reduced the time for error detection and correction from tens of microseconds using conventional software approaches to roughly 1.5 microseconds per correction cycle — addressing a critical barrier to achieving scalable, practical quantum computers.

The system implements an industry-leading distance-5 rotated surface code using 49 physical qubits. Each decoder instance runs on a single QpiAI Kaveri QPU, allowing one decoder instance per chip. The architecture is optimized to support efficient decoding and integration with existing quantum hardware.

"The performance of our new decoder platform demonstrates a practical pathway toward scalable, hardware-accelerated quantum error correction," said QpiAI founder and CEO Nagendra Nagaraja, Ph.D. "Compatible with widely used superconducting transmon qubits, the

platform limits the need for additional classical support from CPUs and GPUs. QpiAI is also developing next-generation error correction methods tailored to our own fluxonium-based qubits as well as architectures designed to operate across distributed systems."

With partial funding by the Indian National Quantum Mission (NQM), Dr Abhay Karandikar, Secretary of Department of Science and Technology (DST) for the Government of India, said QpiAI has achieved a "significant milestone" in support of the government's initiative to develop and deploy quantum technologies on a national scale.

QpiAI QEC Decoder connected to QpiAI Sense Controller

"Quantum error correction (QEC) is essential for scalable quantum computing," Karandikar said. "By implementing distance-5 surface code QEC in custom hardware rather than traditional CPUs, QpiAI is accelerating the deployment of its 64-qubit Kaveri QPU in India, marking a major step toward practical, large-scale quantum utility."

In addition to the decoder's role in achieving these results, QpiAI's quantum processors integrate error-correction architecture with optimised superconducting quantum processor layout and fabrication. The decoder platform also leverages QpiAI Sense quantum control electronics to enable scalable development of quantum processors towards fault-tolerant quantum computing.

Additional features of the decoder platform include:

-The system completes distance5 surface code decoding in up to 40 clock cycles, enabling real-time operation.

-Each error correction cycle completes in ~1.5 microseconds, fast enough to operate within the coherence window of superconducting qubits.

-The system performs five rounds of stabilizer measurements per cycle, enabling detection and correction of both qubit errors and measurement errors.

-With approximate T1 times of 100 microseconds and T2 times of 95 microseconds, the platform

supports multiple correction cycles before decoherence.

-The current platform supports up to 20 decoders operating in parallel, allowing simultaneous error correction across multiple logical qubits.

-Active, closed-loop correction enables on-the-fly qubit corrections, reducing accumulated error rates during execution.

-The decoder supports Pauli errors and measurement errors, making it suitable for practical superconducting quantum noise environments.

-The Kaveri QPU features surface code-friendly qubit connectivity, optimized for efficient stabilizer measurement and decoding.

-The current system has been validated using simulated qubits, with ongoing integration and experimental validation on physical qubits.

Demos of the decoder will be available at various locations in Q2, including the company's U.S. offices in Milpitas, California. For more information, contact the company at info@qpiai.tech.

About QpiAI
QpiAI (https://www.qpiai.tech) is global leader in AI and quantum computing integrating quantum computing and AI vertically to offer solutions to areas like manufacturing, industrial, transportation, finance, pharma and materials. It has various software platforms and products including QpiAI-pro, QpiAI-explorer, QpiAI-logistics, QpiAIopt, QpiAIML, QpiAI-pharma and QpiAI-Matter. With its innovation in commercial grade quantum computing technology, QpiAI is providing impactful advances to generative AI and various industry verticals. For more information, interested parties can contact the company at info@qpiai.tech

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