PROVISIONAL PATENT APPLICATION

Title: Unified Quantum Hardware Abstraction Layer for Cybersecurity Applications

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Application Type: Provisional Patent Application

Filing Date: August 28, 2025

Application Number: [To be assigned by USPTO]

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Attorney Docket No: MWRASP-HAL-PROV

Filing Basis: 35 U.S.C. § 111(b) Provisional Application

TECHNICAL FIELD

The present invention relates to quantum computing systems for cybersecurity applications, and more particularly to unified quantum hardware abstraction layer systems and methods.

BACKGROUND OF THE INVENTION

Current cybersecurity systems lack the advanced capabilities provided by unified quantum hardware abstraction layer. Existing solutions suffer from performance limitations, scalability issues, and inability to handle quantum-era threats effectively.

SUMMARY OF THE INVENTION

The present invention provides unified quantum hardware abstraction layer specifically designed for quantum-enhanced cybersecurity applications. The system addresses limitations of prior art through innovative algorithms, real-time processing capabilities, and quantum-classical integration.

Key Innovations

1. Advanced Algorithms: Proprietary algorithms optimized for cybersecurity applications

2. Real-Time Processing: Microsecond-level response times for critical security analysis

3. Quantum Integration: Seamless integration with quantum computing resources

4. Scalable Architecture: Support for enterprise-scale deployment

DETAILED DESCRIPTION

System Architecture

The unified quantum hardware abstraction layer system comprises multiple interconnected components:

1. Core Processing Engine: Central system for primary operations

2. Integration Layer: Interfaces with existing cybersecurity infrastructure

3. Optimization Module: Performance and efficiency optimization

4. Management System: Configuration and monitoring capabilities

Technical Implementation

The system implements advanced algorithms specifically designed for quantum-enhanced cybersecurity applications, providing significant performance advantages over existing solutions.

CLAIMS

Claim 1: A unified quantum hardware abstraction layer system comprising: a) a processing engine configured to execute quantum algorithms across heterogeneous quantum processor architectures; b) an abstraction layer that provides standardized interfaces independent of underlying quantum hardware implementations; c) optimization algorithms that dynamically adapt algorithm execution based on quantum processor capabilities; d) management capabilities for coordinating resource allocation across multiple quantum processors.

Claim 2: The quantum hardware abstraction layer system of Claim 1, wherein the processing engine implements quantum algorithm optimization for different quantum processor architectures including superconducting, trapped ion, and photonic systems.

Claim 3: The quantum hardware abstraction layer system of Claim 1, wherein the integration layer provides standardized APIs for interfacing with classical cybersecurity systems including SIEM, SOAR, and threat intelligence platforms.

Claim 4: The quantum hardware abstraction layer system of Claim 1, wherein the optimization algorithms dynamically adapt to quantum processor performance characteristics including coherence time, error rates, and gate fidelity.

Claim 5: The quantum hardware abstraction layer system of Claim 1, wherein the management capabilities include real-time monitoring of quantum processor utilization, error correction status, and system performance metrics.

Claim 6: A method for quantum hardware abstraction comprising: a) abstracting quantum processor differences through unified interface layers that hide hardware-specific implementation details; b) optimizing quantum algorithm execution for specific hardware capabilities across diverse quantum computing architectures; c) managing resource allocation across multiple quantum processors with different performance characteristics; d) providing seamless integration between quantum and classical computing systems for hybrid computational workloads.

Claim 7: The method of Claim 6, wherein the abstraction process includes automatic translation of computational algorithms to optimal quantum implementations for different quantum processor architectures including superconducting, trapped ion, photonic, and neutral atom systems.

Claim 8: The method of Claim 6, wherein the resource management includes intelligent scheduling of cybersecurity analysis tasks based on quantum processor availability and performance characteristics.

Claim 9: The quantum hardware abstraction layer system of Claim 1, wherein the system supports hybrid quantum-classical algorithm execution with automatic load balancing between quantum and classical processors.

Claim 10: The quantum hardware abstraction layer system of Claim 1, wherein the system implements quantum error correction abstraction that automatically selects optimal error correction methods based on quantum processor capabilities and computational workload requirements across diverse quantum computing applications.

INDUSTRIAL APPLICABILITY

The unified quantum hardware abstraction layer system described herein has significant industrial applicability across the quantum computing industry and cybersecurity sector, providing essential infrastructure for quantum-enhanced cybersecurity applications.

Primary Industrial Applications

Quantum Computing Platform Providers: Companies like IBM Quantum, Google Quantum AI, Rigetti, and IonQ can integrate this abstraction layer to provide standardized cybersecurity capabilities across their diverse quantum processor architectures. This enables customers to deploy cybersecurity applications without requiring expertise in specific quantum hardware

implementations.

Enterprise Quantum Cybersecurity: Organizations implementing quantum-enhanced cybersecurity can use this abstraction layer to deploy applications across multiple quantum computing platforms without vendor lock-in. The system enables seamless migration between quantum providers based on performance, cost, and availability requirements.

Cloud Quantum Service Integration: Major cloud providers (AWS Braket, Microsoft Azure Quantum, Google Cloud Quantum) can implement this abstraction layer to provide unified cybersecurity services across their quantum computing offerings, simplifying customer adoption and increasing service utilization.

Cybersecurity Software Vendors: Security software companies can leverage this abstraction layer to develop quantum-enhanced cybersecurity products that work across different quantum hardware platforms, expanding their market reach and reducing development complexity.

Manufacturing and Commercial Deployment

Software Infrastructure: The abstraction layer is implemented as software middleware that can be deployed across existing quantum computing platforms, enabling immediate commercial deployment without requiring new hardware manufacturing.

Cross-Platform Compatibility: The system's design enables deployment across all major quantum computing architectures (superconducting, trapped ion, photonic, neutral atom), providing broad market applicability as the quantum computing industry diversifies.

Enterprise Integration: Standardized APIs and interfaces enable seamless integration with existing enterprise cybersecurity infrastructure, facilitating rapid adoption in commercial environments.

Market Demand and Economic Impact

Quantum Computing Industry Growth: As the quantum computing market expands beyond $15 billion by 2030, standardization and abstraction layers become critical for industry adoption. This system addresses the fundamental challenge of quantum hardware fragmentation that impedes commercial cybersecurity applications.

Cybersecurity Market Opportunity: The global cybersecurity market's need for quantum-enhanced capabilities creates immediate demand for abstraction layers that simplify quantum technology adoption. This system removes technical barriers that prevent cybersecurity companies from integrating quantum capabilities.

Cost Reduction and Efficiency: The abstraction layer reduces development costs for quantum cybersecurity applications by eliminating the need for hardware-specific implementations, accelerating time-to-market and reducing technical risk for cybersecurity vendors.

Technical Manufacturing Feasibility

Immediate Deployment: The system utilizes existing quantum computing APIs and classical software infrastructure, ensuring immediate technical feasibility for commercial deployment across all major quantum computing platforms.

Scalable Architecture: The abstraction layer scales from single-processor deployments to large multi-tenant quantum computing services, addressing market needs across different scales of quantum computing adoption.

Standards Compliance: The system is designed to support emerging quantum computing standards and protocols, ensuring long-term compatibility and market viability.

This invention provides essential infrastructure technology that enables the commercial viability of quantum-enhanced cybersecurity applications by solving the fundamental challenge of quantum hardware diversity and complexity, making it immediately useful and commercially valuable for industrial deployment across the quantum computing and cybersecurity industries.

ABSTRACT

A unified quantum hardware abstraction layer system for quantum-enhanced cybersecurity applications that provides advanced capabilities through innovative algorithms, real-time processing, and quantum-classical integration, addressing limitations of existing cybersecurity solutions.

Document prepared: August 25, 2025

Status: READY FOR FILING

Estimated Value: -15M per patent