Proposal: Quantum-AI Integrated Robotic Systems for Applied Industry Use Cases

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# 1. Executive Summary

This proposal outlines the development of a Quantum-AI (QAI) integrated robotic platform aimed at revolutionizing applied utility robotics. The system leverages hybrid AI models and quantum algorithms to enable intelligent decision-making, real-time perception, and energy-efficient control for robotics across domestic, industrial, and public safety domains. Developed by Bhadale IT Innovations Pvt. Ltd., this solution positions itself at the intersection of applied research and scalable productization.

# 2. Problem Statement

Robotics systems today lack the computational adaptability, real-time learning ability, and energy efficiency required for deployment in diverse environments. Classical AI models face limitations in generalization, robustness, and on-chip efficiency—especially in dynamic environments. Quantum computing offers enhanced search, optimization, and simulation capabilities that, when integrated with AI, can address these gaps in autonomous robotics.

# 3. Proposed Solution

We propose a modular, scalable Quantum-AI integration framework that supports:  
- Quantum-enhanced decision systems  
- Edge-deployable AI models (e.g., Spiking NNs)  
- Classical-Quantum co-processing for noise-tolerant perception  
- Sim-to-real transfer using QPU-accelerated learning  
  
This will be tested on a humanoid robot performing real-world tasks.

# 4. Innovation and Uniqueness

The novelty lies in combining:  
- Quantum Neural Networks for classification and control  
- Quantum circuit optimization for robotic simulation tasks  
- Consciousness-inspired modules for goal selection  
- A fallback AI engine using classical simulators when QPUs are not available

# 5. Market Opportunity

Our primary target markets include:  
- Domestic robotics (elder care, smart home management)  
- Industrial safety inspection (hazard zones, autonomous transport)  
- Defense and emergency responders  
  
The global robotics market is projected to exceed $250B by 2030, with quantum-enhanced systems gaining investment interest from major tech firms.

# 6. Methodology (Applied + STAR Format)

Our methodology integrates applied research with system-level development using a STAR-inspired structure:  
  
Situation: Robotics lack adaptive cognitive intelligence in changing environments.  
Task: Design a hybrid QAI system that can learn, reason, and adapt in real time.  
Action: Develop modular components:  
- Quantum SNN for decision-making  
- AI fallback engine for edge operation  
- Simulator with quantum circuit augmentation for training  
- Humanoid interface modules for environment interaction  
Result: A testable prototype capable of home tasks, surveillance, and inspection using hybrid quantum-classical intelligence.

# 7. Technical Architecture

The proposed architecture includes the following core components:  
- Quantum-Classical Hybrid Processor (QPU-GPU integration)  
- Quantum Spiking Neural Networks (QSNN)  
- Classical Simulation & Control fallback module  
- Sensor Input and Real-World Feedback Loop  
- Command Interface + Task Layer (voice/text interaction)  
  
[Insert QAI System Diagram Here]

# 8. Expected Outcomes & TRL Progression

- TRL 3: Proof-of-concept (6 months)  
- TRL 4: Bench-level integration of QAI modules (12 months)  
- TRL 5: Simulated humanoid robot demos (18 months)  
- TRL 6: Pilot-ready prototype with real-world testing (24–30 months)

# 9. Timeline and Milestones

The development will be divided into 3 phases:  
Phase 1 (0–6 months): Design, QAI module integration  
Phase 2 (6–18 months): Simulation & Edge deployment trials  
Phase 3 (18–30 months): Real-world pilot, commercialization prep  
  
[Insert GANTT Chart Here]

# 10. Budget Overview and Commercialization Plan

Estimated Budget:  
- Research Personnel: €100,000  
- QPU/Cloud Credits: €50,000  
- Hardware and Testing: €75,000  
- Travel & Contingency: €25,000  
- Total Estimated Budget: €250,000  
  
Commercialization:  
Phase 1: Early pilots with industrial and defense clients  
Phase 2: SaaS platform for QAI Robotics Simulation & Deployment  
Phase 3: Licensing and Joint Ventures for customized deployments

# 11. Team Structure, Ask, and Risk Management

Principal Investigator: Dr. Vijay Mohire  
Affiliation: Bhadale IT Innovations Pvt. Ltd.  
  
Collaborators: TBD (Universities, Industry Tech Providers)  
  
Ask:  
- €250,000 Seed Investment for 24–30 months  
- Access to QPU Testbeds (IBM Q, IonQ, Rigetti)  
- Strategic Partners for Hardware and Deployment  
  
Risks:  
- Quantum hardware instability (Mitigated by fallback simulators)  
- Integration delays (Handled by modular architecture)  
- Limited ecosystem adoption (Addressed through pilot demos and hybrid support)

# 12. Conclusion

Our QAI-integrated robotic framework aims to make cutting-edge quantum and AI capabilities practical and useful for the next generation of robotic platforms. Backed by solid applied research methodology and commercialization potential, we are seeking strategic investors and partners to bring this transformative vision to life.