BHADALE GROUP OF COMPANIES
- IT AND REAL ESTATE

Jun 14 2022

Quantum Products Catalogue

Bhadale IT Pvt. Ltd. (https://www.bhadaleit.com/)

Bhadale Group of Companies

Bhadale Group of Companies consists of:

1. **Bhadale IT Pvt. Ltd** is an IT and Computer Engineering subsidiary company

   This division provides consultation in areas of cutting edge technologies, research outsourcing, and software consultation related to data center and related engineering practices

2. **Bhadale Engineering Pvt. Ltd** is a multi-engineering subsidiary company

Various divisions under this group provide design, & development of various IT and Engineering programs.

Bhadale Group has aggressive programs in place to serve the niche market. Below is related to cloud ecosystems
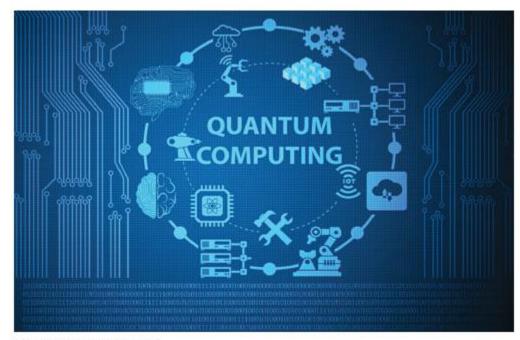
Bhadale Group IT Division, Quantum Services department

 Below are few of our product offerings:

1. QML platform for error corrections
2. Distillation platform
3. Quantum Internet based products
4. Highly scalable NISQ computer platforms and frameworks
5. Converged quantum systems for Ultra Performance Computing

Details of the above are put in the table below. In brief our products are well documented and are based on industry research and technology progress. We use the scientific axioms and engineered approaches to deliver our products that can be placed in maturity models like the TRL levels, SEI-CMM Levels, etc

Service details

(Credit: www.eweek.com)

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We have a large set of subcategories; few are mentioned below with details tabulated

Pro duct No	Product Name	Key Products / features
1	QML platform for error corrections	This product offers the Quantum Machine Learning based platform, framework, processes, models and the improved error codes to detect, isolate, refine/ distill the quantum state using several of the existing and newer codes and algorithms. The platform is a bundle deployed in a container with appropriate stack for deployment and quick start on the product Please refer [1],[2],[3] for further details
2	Distillation platform	This product offers the Quantum entanglement based platform, framework, processes, models and the improved distillation process to detect, isolate, refine/ distill the quantum entanglement The platform is a bundle deployed in a container with appropriate stack for deployment and quick start on the product Please refer [4],[5] for further details

3	Quantum Internet based products	1. Quantum Internet adaption kit 2. Quantum Communications architectures – extensions to existing and newer frameworks 3. Quantum repeater design kit 4. Quantum RAN adoption kit 5. Security infrastructure adoption kits: Post- quantum cryptography, One-time pad, QKD, etc 6. Adoption kits for various industrial frameworks like Big Data, Industry 4.0, Telecom , Real-time systems, Banking, Health Care etc Please refer [6],[7] for further details
4	Highly scalable NISQ computer platforms and frameworks	1. Classical and Quantum Noise reduction kits - noise reduction 2. NISQ based computer architecture kit – computing related 3. Integrated Framework for optimized systems design kit – Co-design kits 4. Design patterns kit 5. Shared services kits IEEE 2995 standards, speed up frameworks, trial frameworks, etc are referred. Please refer [8],[9] for further details
5	Cryo-electronics ICs –MOSFET, nano coated FET adoption kit	1. Starter kits to adapt the cryogenic technology based electronic circuitry and chipsets 2. Frameworks to assemble and integrate the hardware units and software control units using the optimized network channels 3. Nano-technology adaption kit for various devices and replacement configurations Please refer [10] for further details
6	Converged quantum systems for Ultra Performance Computing (UPC)	1. Various systems configuration for UPC using various products for classical and quantum inventories 2. Standardization kits to reach the speedup limits and supremacy 3. Measurement and validation kits for test-beds / testing the high performance Please refer [11],[12] for further details
7	Industry 4.0 quantum LAN – end nodes, repeaters, cryptography, overlay of QNW over classical for the simple web ,	1. Quantum Industry 4.0 adaption kit 2. Industrial IoT quantum system kit 3. Industrial cloud kit 4. Industrial network design kit 5. Quantum network Overlays 6. Cyber Physical Systems (CPS) kit 7. Industrial quantum security kit

	data exchange	Please refer [13] for further details
8	Quantum cryptography – QKD based various data transfers (in space, ground to space, and space to ground)	1. Satellite and airborne quantum cryptography kit 2. Flight and navigational quantum systems kit 3. Shipment and logistics planning kit 4. Satellite phone, Cellular RAN quantum design kit 5. Quantum Mobile phone cryptography kit 6. Global navigation quantum kit 7. Quantum based optimization kit for congestion, routing and traffic related management 8. Military grade QKD systems kit 9. Non-GPS based quantum systems design Please refer [14],[15] for further details
9	Quantum for defense systems – for guided missiles, ICMB, reconnaissance	1. Patriot missiles/ self defense enhanced systems kit 2. Long-range missile error correction kit 3. Complex route planning and onboard quantum computing kit 4. Autonomous blind navigation quantum system kit for degraded systems 5. Complex homing guidance kit 6. Big data analysis of coded messages and data using quantum IT kit 7. Outer space reentry and repositioning quantum kit 8. Underwater navy submarine kit for complex missile deployment 9. Integrated defense warfare quantum network kit Please refer [16],[17],[18] for further details
10	Q for socio-economic prosperity – resource pooling, sharing, economic usage, distorted malpractice detections in all walks of resource management	1. Human life cycle management quantum kit - birth, schooling, education, hiring, promotions , retirements, opportunities with anomalies detection for various impediments and external human biases 2. History repeats again patterns analysis kit – using various parameters like race, religion, origin, wrong hiring, misappropriated job/salary/ promotion offers using various pretext, origins, family and friend circles 3. Rolling up of data right from an individual to a family, community, societies, region, company, region, nation and global levels – prosperity analysis and right intervention at right time without boundaries 4. Global economy complex dataset analysis to discover patterns for offering right assets, resources etc 5. Integrated global quantum grid for various portfolio and governance management systems Please refer [19],[20],[21] for further details
11	Govt. less autonomous Quantum AI – using explainable AI that is	1. Expert AI systems for various industrial use cases and decision making features 2. Expert ML systems that learn to adjust to the proper decision taking by reading vast amount of data and building a knowledge based decision graph system

	approved by various neutral parties (block chain based) , for proper decision taking, portfolios, sectors	3. Quantum computing system to learn several years of human expert experiences within few weeks 4. Storage system for the learning to classical and quantum system base like data lake , data warehouse 5. Human-in the loop system with minimal supervision and approvals when there is a critical decision to be taken Please refer[22] for further details
12	General QApps – Empower user with cloud based solutions- using our home grown Solution Café to solve various real-time issues, real-time threat, fulfillment of social needs, social security's, etc	1. Quantum mobile apps on end nodes/ mobiles for various use cases and offline computing 2. Quantum cloud apps on desktops / laptops for various small workloads as permissible 3. Large workload, quantum system apps mainly for running in a datacenter 4. Solution Café app for integrated solutions for various types of users and industrial uses 5. Police patrol engine, apps for real –time threat detection, computation of plan to nab the criminals 6. Large crowd monitoring and management systems 7. Terrorist counter attack strategy apps and mobile systems 8. Safe landing and homing guidance systems for airlines 9. Instant search for problem solutions where life threats, gang war or being held hostage 10. Various residential living standards improvement gadgets
13	Deep Reinforcement Learning with Quantum-inspired Experience Replay	1. ML systems with experience replay using quantum computing, models and external/ human interventions to help the learning process 2. Various libraries for different environment and mission conditions Please refer[23] for further details
14	Development of quantum interconnects (quics) for next-generation information technologies	1. Homogeneous Qubit-Qubit Interconnects 2. Tunable quantum inter-conversion between disparate photons (e.g., tunable visible-to-telecom or optical-to-microwave, including bandwidth conversion). 3. Heterogeneous Qubit-Qubit Interconnects Please refer[24] for further details
15	Quantum circuits with many photons on a programmable nanophotonic chip	1. Use case based quantum system (circuitry plan and design) 2. Custom libraries using Pennylane, Qiskit and other frameworks Please refer[25] for further details

16	Software tools for quantum control: Improving quantum computer performance through noise and error suppression	1. Industry 4.0 architecture(like Q-CTRL) based custom libraries 2. Industrial use cases based libraries for noise and error suppression 3. Various control mechanisms using classical and quantum gates like PID, quantum distillation, digital noise filters Please refer[26] for further details
17	A novel quantum neural network based on multi-level activation function	1. Custom NN system using multi-level inputs and feedbacks 2. Custom activator functions/ Quantum perceptrons library using various ensembles Please refer[27],[28] for further details
18	Distributed Quantum Computing and Network Control for Accelerated VQE	1. Distributed quantum algorithm system with network adapters, interconnects and control 2. Library packages for algorithm decomposition and parallelization 3. Advanced quantum network operating system based acceleration stack Please refer[29],[30] for further details
19	Quantum speedup in adaptive boosting of binary classification	1. AdaBoost based quadratic quantum speedup system 2. Library of boosting algorithms, circuits and platform Please refer[31],[32] ,[33] for further details
20	Telecom-heralded entanglement between remote multimode solid-state quantum memories	1. Entanglement preparation and management system for Telecom multimodes using quantum network, memories, concepts like DWDM, OFDM, Mux/Demux , optics 2. Related software libraries that enable the experimental setup, demo , testing and approvals Please refer[34] for further details
21	Binary quantum-inspired gravitational search algorithm-based multi-criteria scheduling for multi-processor computing systems	1. Quantum Scheduling system for various use cases that allows multi-criteria inputs and multiple computing nodes architecture Please refer[35] for further details

22	Hybrid quantum-classical graph convolutional network	1. Hi speed converged CNN system for High energy physics (HEP) systems Please refer[36] for further details
23	Realization of a multinode quantum network of remote solid-state qubits	1. Design kit for the quantum network using solid-state qubits Please refer[37] for further details
24	Pricing Financial Derivatives with Exponential Quantum Speedup	1. Pricing systems that take advantage of real-time and hi-speed computing for spot, real-time, daily trade and at set regular interval trading 2. Interfaces and libraries for various banking, dashboards, datasets, commercial data feeds and stock market integration Please refer[38] ,[39] for further details
25	Hybrid quantum-classical algorithms and quantum error mitigation	1. Combinational algorithm sets for various use cases and industrial purposes 2. Libraries of error correction codes and improved design well integrated with the above algorithm sets Please refer[40] ,[41],[42],[43] for further details
26	Quantum Neuromorphic Computation	1. Converged systems design using Quantum Neuromorphic, AI, classical paradigms that offer value to various use cases, industrial challenges and real life situations related to performance, speed, time, schedules, quality etc Please refer [44] ,[45],[46],[47],[48],[49] for further details
27	Neural-network heuristics for adaptive Bayesian quantum estimation	1. Machine learning system to create fast and strong experiment-design heuristics for Bayesian quantum estimation Please refer [50] ,[51] for further details
28	Multilevel combinatorial optimization across quantum architectures	1. Robust multilevel solvers systems for combinatorial optimization problems using global optima (Graphs, QUBO, algorithms, NISQ systems) Please refer [52] ,[53] for further details

29	Adaptive pruning-based optimization of parameterized quantum circuits	1. Parameter-Efficient Circuit Training based optimization kit for quantum hardware, ansatze and algorithms Please refer [54] for further details
30	Hyper-optimized tensor network contraction	1. Optimized tensor network design 2. Libraries related to algorithms and techniques used Please refer [55] for further details
31	Machine learning of noise-resilient quantum circuits	1. Noise-aware circuit learning (NACL) system with ML model and circuit design Please refer [56] for further details
32	A decision procedure for unitary linear quantum cellular automata	1. Testing system for linear quantum cellular automaton to be unitary Please refer [57] for further details
33	Quantum Error Mitigation using Symmetry Expansion	1. NISQ computer error reduction system Please refer [58] for further details
34	Quantum information scrambling on a superconducting qutrit processor	1. System design to scramble qutrit data Please refer [59],[60],[61] for further details
35	Neural networks and quantum field theory	1. NN System for QFT for various use case, networks and telecom units Please refer [62],[63],[64] for further details
36	Optimal Quantum Control Theory	1. Control designs for quantum systems Please refer [65],[66],[67],[68] for further details
37	Effective routing design for remote	1. Entanglement Routing protocol based system for various parameters and quality needs

	entanglement generation on quantum networks	Please refer [69],[70] for further details
38	Quantum repeater nodes with absorptive quantum memories	1. Solid-state quantum repeaters design for high-speed quantum networks Please refer [71] for further details
39	Protecting a bosonic qubit with autonomous quantum error correction	1. System design for error correction Please refer [72],[73] for further details
40	Dynamic Cost Ant Colony Algorithm to Optimize Query for Distributed Database Based on Quantum-Inspired Approach	1. Database Engine to improve the cost of query joins in distributed databases Please refer [74],[75] for further details
41	Bidirectional teleportation for underwater quantum communications	1. Quantum System design for underwater communication Please refer [76] for further details
42	HASCO: Towards Agile Hardware and Software CO-design for Tensor Computation	1. System co-design methods and implementation guide Please refer [77] for further details
43	Layerwise learning for quantum neural networks	1. Layer Learning QNN Please refer [78],[79] for further details
44	An optical neural chip for implementing complex-valued	1. System Design of Optical Neural Network Please refer [80] for further details

	neural network	
45	An efficient quantum algorithm for the time evolution of parameterized circuits	1. System design for efficient quantum algorithm for parameterized circuits Please refer [81] for further details

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