

# **DISTRIBUTED COMPUTING ARCHITECTURE PATENT**

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**Summit Digital Solutions, Inc.**

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## **ABSTRACT**

A system and method for distributed computing architecture enabling real-time processing of enterprise IoT sensor data across multiple edge computing nodes. The invention comprises a hierarchical network of processing units that dynamically allocate computational resources based on workload demands and data proximity, utilizing machine learning algorithms to optimize resource distribution and minimize latency in complex industrial environments.

## **BACKGROUND OF THE INVENTION**

[0001] Modern enterprise environments generate massive quantities of sensor data requiring immediate processing for operational decision-making. Traditional centralized computing architectures face significant challenges in processing such data volumes with acceptable latency.

[0002] Existing solutions typically rely on cloud-based processing which introduces delays and bandwidth constraints. The present invention addresses these limitations through an innovative distributed architecture optimized for enterprise IoT implementations.

## **SUMMARY OF THE INVENTION**

[0003] The present invention provides a distributed computing architecture comprising:

- A network of edge computing nodes positioned proximally to IoT sensor clusters
- Dynamic workload balancing algorithms utilizing machine learning for resource optimization
- Real-time data processing capabilities with sub-10ms latency
- Automated node failure recovery and workload redistribution
- Secure inter-node communication protocols with end-to-end encryption

## **DETAILED DESCRIPTION**

[0004] The distributed computing architecture comprises multiple hierarchical layers:

### **Edge Layer**

- Local processing units directly connected to IoT sensor arrays
- Initial data filtering and preliminary analytics
- Local cache management and data compression
- Autonomous operation capability during network interruption

### **Aggregation Layer**

- Regional processing nodes aggregating multiple edge units
- Complex analytics and pattern recognition
- Machine learning model execution
- Load balancing and resource allocation

### **Core Layer**

- Central coordination and global optimization
- Enterprise-wide analytics and reporting
- System health monitoring and maintenance
- Security policy enforcement

[0005] The system employs proprietary algorithms for:

- Workload distribution optimization
- Predictive maintenance
- Anomaly detection
- Resource utilization forecasting

## **CLAIMS**

A distributed computing system comprising:

- a. A plurality of edge computing nodes
- b. Machine learning-based resource allocation
- c. Automated failover mechanisms

d. Secure inter-node communication protocols

The system of claim 1, wherein said edge computing nodes:

- a. Process IoT sensor data in real-time
- b. Maintain local data caches
- c. Execute preliminary analytics
- d. Operate autonomously during network interruption

The system of claim 1, further comprising:

- a. Dynamic workload balancing
- b. Predictive maintenance capabilities
- c. Anomaly detection mechanisms
- d. Resource utilization optimization

## **DRAWINGS**

[0006] Figure 1: System Architecture Diagram

[0007] Figure 2: Data Flow Schematic

[0008] Figure 3: Node Communication Protocol

[0009] Figure 4: Resource Allocation Workflow

## **TECHNICAL FIELD**

[0010] The invention relates to distributed computing systems, specifically architectures optimized for enterprise IoT implementations requiring real-time data processing and analysis.

## **INDUSTRIAL APPLICABILITY**

[0011] This invention has direct application in:

- Manufacturing process optimization
- Supply chain management
- Industrial automation
- Smart facility management
- Enterprise resource planning

## **PRIOR ART REFERENCES**

[0012] The following patents and publications are incorporated by reference:

- US Patent 10,234,567
- US Patent 10,876,543
- US Patent Application 2020/0123456

## **EXECUTION**

IN WITNESS WHEREOF, the undersigned inventors have executed this patent application as of the date first written above.

/s/ Michael Chang

Michael Chang, Chief Technology Officer

Summit Digital Solutions, Inc.

/s/ Dr. Robert Martinez

Dr. Robert Martinez, Chief Innovation Officer

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/s/ James Henderson

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Summit Digital Solutions, Inc.

STATE OF DELAWARE

COUNTY OF NEW CASTLE

Subscribed and sworn to before me on March 15, 2019

/s/ Sarah Johnson

Notary Public

My Commission Expires: December 31, 2024