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Edge Computing Architecture for Distributed IoT Processing

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ABSTRACT

A system and method for distributed edge computing architecture enabling real-time processing of IoT sensor data through hierarchical node deployment. The invention comprises a multi-tiered processing framework that optimizes computational resource allocation across edge devices while maintaining data integrity and processing efficiency. The architecture implements dynamic load balancing and fault tolerance through proprietary algorithms that adapt to network conditions and processing demands.

CLAIMS

A distributed edge computing system comprising:

a. A plurality of edge nodes configured to:

i. Collect real-time data from IoT sensors

ii. Perform preliminary data processing using configurable algorithms

iii. Implement local decision making based on predefined parameters

b. A middleware layer configured to:

i. Coordinate communication between edge nodes

ii. Manage resource allocation across the network

iii. Execute load balancing protocols

c. A central processing hub configured to:

i. Aggregate processed data from edge nodes

ii. Perform advanced analytics

iii. Update edge node parameters based on system-wide optimization

The system of claim 1, wherein the edge nodes implement:

a. Local data storage with configurable retention policies

b. Real-time processing capabilities with <10ms latency

c. Secure communication protocols using AES-256 encryption

A method for distributed processing comprising:

a. Receiving sensor data at edge nodes

b. Processing data according to node-specific parameters

c. Transmitting processed results to middleware layer

d. Aggregating results at central processing hub

The method of claim 3, further comprising:

a. Dynamic resource allocation based on processing loads

b. Automated failover protocols

c. Real-time optimization of processing parameters

DETAILED DESCRIPTION

Technical Field

The present invention relates to distributed computing architectures, specifically focusing on edge computing implementations for IoT environments. The invention provides novel approaches to managing distributed processing resources while maintaining system reliability and data integrity.

Background

Traditional centralized processing architectures face limitations in IoT environments due to bandwidth constraints and latency requirements. This invention addresses these challenges through innovative edge computing approaches that optimize resource utilization while ensuring processing efficiency.

Detailed Implementation

The invention implements a three-tier architecture:

Edge Layer

- Comprises distributed processing nodes
- Implements local storage and processing capabilities
- Utilizes proprietary algorithms for data optimization

Middleware Layer

- Manages inter-node communication
- Implements load balancing protocols
- Ensures system reliability through redundancy

Central Processing Layer

- Aggregates processed data
- Performs system-wide optimization
- Manages configuration updates

Technical Specifications

The system implements:

- Processing latency: <10ms at edge nodes
- Encryption: AES-256 for data in transit
- Scalability: Support for up to 10,000 concurrent edge nodes
- Fault tolerance: 99.999% uptime through redundancy

LEGAL NOTICES

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EXECUTION

IN WITNESS WHEREOF, this patent document has been executed by the below-named inventors and assigned to Summit Digital Solutions, Inc.

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