

# **PATENT SPECIFICATION**

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**UNITED STATES PATENT APPLICATION NO. 16/78**

**Title: SYSTEM AND METHOD FOR COLD-ENVIRONMENT POWER**

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## ABSTRACT

A system and method for distributing power in autonomous mobile robots operating in sub-zero environments, comprising a thermally-isolated power distribution unit, temperature-compensating voltage regulators, and an adaptive power management system. The BlueCore(TM) power distribution system maintains battery performance and power delivery in environments ranging from -40°C through proprietary thermal management and voltage stabilization techniques.

## BACKGROUND

[0001] Autonomous mobile robots operating in cold storage environments face significant challenges related to power distribution and battery performance. Conventional power systems experience substantial efficiency losses and reliability issues when operating in sub-zero temperatures.

[0002]-Existing solutions fail to adequately address the unique requirements of cold-environment robotics, particularly in maintaining consistent voltage levels and preventing thermal-induced power fluctuations.

## **SUMMARY OF THE INVENTION**

[0003] The present invention provides a novel power distribution system specifically designed for autonomous mobile robots operating in extreme environments. The BlueCore(TM) system comprises:

a) A thermally-isolated power distribution unit (PDU) incorporating:

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Multi-layer insulation technology

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Active thermal management subsystem

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Temperature-compensating voltage regulators

b) An adaptive power management system featuring:

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Real-time temperature monitoring

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Dynamic power allocation algorithms

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Predictive thermal compensation

## **DETAILED DESCRIPTION**

### **[0004] Power Distribution Unit**

The PDU incorporates proprietary thermal isolation technology utilizing

multi-layer composite structure comprising:

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Outer layer: High-density polyethylene shell

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Middle layer: Vacuum-sealed aerogel insulation

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Inner layer: Phase-change material thermal buffer

### **[0005] Voltage Regulation System**

The temperature-compensating voltage regulators employ:

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Adaptive feedback loops monitoring temperature-induced impedance

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Dynamic duty cycle adjustment based on thermal conditions

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Redundant regulation pathways with automatic failover

### **[0006] Power Management Architecture**

The system implements a hierarchical power management architecture

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Primary power bus operating at 48VDC nominal

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Secondary distribution network at 12VDC and 5VDC

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Isolated control signal bus

## **CLAIMS**

A power distribution system for cold-environment autonomous mobile

- a) A thermally-isolated power distribution unit;
- b) Temperature-compensating voltage regulators;
- c) An adaptive power management system;

wherein said system maintains stable power delivery in environments between -40 C and +25 C.

The system of claim 1, wherein the thermally-isolated power distribution unit includes:

- a) A multi-layer composite structure;
- b) Active thermal management components;
- c) Integrated temperature sensors.

The system of claim 1, wherein the adaptive power management system includes:

- a) Real-time temperature monitoring;
- b) Dynamic power allocation;

c) Predictive thermal compensation algorithms.

## **DRAWINGS**

[0007] FIG. 1 illustrates the overall architecture of the BlueCore(TM) power distribution system.

[0008] FIG. 2 shows the internal structure of the thermally-isolated PDC.

[0009] FIG. 3 depicts the power management control flow.

## **DECLARATION AND POWER OF ATTORNEY**

I hereby declare that:

-

I am the original inventor of the subject matter described herein

-



I have reviewed and understand the contents of this application

-

I acknowledge the duty to disclose all material information

**/s/ Elena Frost\_**

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