

COLD-RESISTANT CIRCUIT DESIGN PATENT

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UNITED STATES PATENT APPLICATION NO. 16/78

TITLE OF INVENTION

System and Method for Temperature-Hardened Circuit Architecture in Autonomous
Mobile Robots

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims priority to U.S. Provisional Application No. 62/798,611, filed March 15, 2019.

FIELD OF INVENTION

[0001] The present invention relates generally to cold-environment electronics and specifically to temperature-resistant circuit designs for autonomous mobile robots operating in sub-zero environments.

BACKGROUND

[0002] Autonomous mobile robots operating in cold storage environments face significant challenges related to circuit performance and reliability at low temperatures. Conventional circuit designs experience reduced efficiency, component failures, and signal degradation when exposed to sustained sub-zero conditions.

[0003] Prior attempts to address these challenges have relied primarily on external heating elements and insulation, resulting in increased power consumption and reduced operational efficiency.

SUMMARY OF INVENTION

[0004] The present invention provides a novel circuit architecture specifically designed for reliable operation in extreme cold environments. The system comprises:

(a) A multi-layer thermal management substrate incorporating:

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Nano-carbon heat distribution channels

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Self-regulating thermal equilibrium zones

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Temperature-gradient compensating interconnects

(b) Advanced component configuration featuring:

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Cold-optimized semiconductor junctions

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Temperature-adaptive clock management

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Thermal feedback control loops

DETAILED DESCRIPTION

[0005] The invention's primary components include:

Thermal Management System

[0006] The substrate utilizes proprietary nano-carbon channels arranged in a hexagonal matrix pattern, providing uniform heat distribution across critical circuit components. The channel density varies according to the thermal requirements of different functional zones.

Component Architecture

[0007] Circuit components are arranged in thermal clusters, with high-heat generating elements positioned to provide passive warming to temperature-sensitive components. The architecture incorporates redundant pathways for critical functions.

Control Systems

[0008] A dedicated microcontroller monitors temperature across 24 distinct zones, adjusting clock speeds and power distribution in real-time to maintain optimal operating conditions.

CLAIMS

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A cold-resistant circuit system comprising:

- a. A thermal management substrate incorporating nano-carbon heat distribution channels
- b. Temperature-adaptive clock management system

c. Thermal feedback control loops

d. Self-regulating thermal equilibrium zones

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The system of claim 1, wherein the nano-carbon channels are arranged in a h

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The system of claim 1, wherein the clock management system automatically

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A method for maintaining circuit performance in sub-zero environments com

a. Monitoring temperature across multiple circuit zones

b. Adjusting power distribution based on thermal feedback

c. Managing component clock speeds to optimize performance

d. Maintaining thermal equilibrium through passive heat distribution

ABSTRACT

A system and method for temperature-hardened circuit architecture designed for autonomous mobile robots operating in extreme cold environments. The invention incorporates nano-carbon heat distribution channels, self-regulating thermal equilibrium zones, and temperature-adaptive clock management systems to maintain optimal circuit performance in sub-zero conditions.

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FILING INFORMATION

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I hereby declare that all statements made herein of my own knowledge are true
and that all statements made on information and belief are believed to be true

/s/ Dr. Elena Frost

Dr. Elena Frost

Chief Executive Officer

Polar Dynamics Robotics, Inc.

Date: February 12, 2020

