PATENT: POLAR-OPTIMIZED BATTERY MANAGEMENT SYSTEM

PATENT APPLICATION

POLAR-OPTIMIZED BATTERY MANAGEMENT SY

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Inventors: Marcus Chen, Dr. James Barrett, Sarah Wu

Assignee: Polar Dynamics Robotics, Inc.

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ABSTRACT

A system and method for optimizing battery performance in extreme cold environments, specifically for autonomous mobile robots operating in sub-ze temperatures. The invention comprises an intelligent thermal management sy that maintains optimal battery temperature while maximizing power efficien through predictive modeling and dynamic load balancing.

BACKGROUND

[0001] Autonomous mobile robots operating in cold storage environments fa significant challenges related to battery performance and longevity. Traditio lithium-ion batteries experience severely reduced capacity and increased internal resistance at temperatures below -20°C.

[0002] Existing solutions typically rely on energy-intensive heating elements

that significantly reduce overall system efficiency and operating time.

SUMMARY OF THE INVENTION

[0003] The present invention provides a novel battery management system specifically designed for extreme cold environments, comprising:

a) An intelligent thermal management subsystem utilizing phase-change mat and variable-conductance heat pipes;

b) Predictive temperature modeling algorithms that optimize power distributi based on anticipated workload and environmental conditions;

c) A multi-cell battery architecture with independent thermal zones and selective cell activation.

DETAILED DESCRIPTION

Thermal Management Subsystem

[0004] The thermal management subsystem comprises:

- A network of variable-conductance heat pipes filled with proprietary workin
- Phase-change material chambers strategically positioned around battery cells
- Microprocessor-controlled thermal switches
- Temperature sensors with 0.1°C accuracy

[0005] The system maintains battery cell temperature between -5°C and +10°C while ambient temperatures range from -40°C to +25°C.

Predictive Modeling System

[0006] The predictive modeling system employs:

- Machine learning algorithms trained on historical performance data
- Real-time environmental sensor inputs
- Dynamic workload profiling
- Adaptive power allocation protocols

Multi-Cell Architecture

[0007] The battery pack comprises:

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16 independent cell groups

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Individual thermal management zones

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Selective cell activation based on demand

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Redundant power pathways

CLAIMS

A battery management system for cold-environment autonomous robots com

a) A thermal management subsystem utilizing phase-change materials;

b) Predictive temperature modeling algorithms;

c) Multi-cell architecture with independent thermal zones.

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The system of claim 1, wherein the thermal management subsystem maintain

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The system of claim 1, wherein the predictive modeling system optimizes po

[Claims 4-20 omitted for brevity]

DRAWINGS

[Fig. 1] System architecture diagram

[Fig. 2] Thermal management flow schematic

[Fig. 3] Cell group configuration

[Figs. 4-12 omitted for brevity]

DECLARATION AND POWER OF ATTORNEY

I hereby declare that:

(1) Each inventor's residence is stated below their name above.

(2) I believe the inventors named above to be the original and first inventors of the subject matter claimed.

(3) I acknowledge the duty to disclose information material to patentability.

SIGNATURES

/Marcus Chen/

Marcus Chen

Date: March 15, 2022

/James Barrett/

Dr. James Barrett

Date: March 15, 2022

/Sarah Wu/

Sarah Wu

Date: March 15, 2022

ATTORNEY DOCKET INFORMATION

Attorney Docket No.: PDR-2022-BMS-001

Law Firm: Morrison & Thompson LLP

Attorney: Elizabeth R. Morgan, Reg. No. 58,723

Address: 1700 Technology Drive, Suite 300

Boston, MA 02110

[End of Patent Application]