

COLD WEATHER PERFORMANCE TESTING METHODS PATENT

COLD WEATHER PERFORMANCE TESTING

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Assignee: Polar Dynamics Robotics, Inc.

ABSTRACT

A method and system for testing autonomous mobile robot performance in cold weather conditions, comprising standardized protocols for evaluating navigation accuracy, power system efficiency, and mechanical component

reliability at temperatures ranging from 0°C to -40°C. The invention includes proprietary testing chambers, sensor calibration procedures, and performance measurement methodologies specifically designed for cold storage and industrial freezer environments.

BACKGROUND OF THE INVENTION

[0001] Autonomous mobile robots operating in temperature-controlled environments face unique challenges related to battery performance, sensor accuracy, and mechanical stress. Existing testing methods fail to adequately evaluate robot performance under sustained cold conditions, particularly in industrial freezer applications where temperatures regularly reach -30°C or lower.

[0002] Current testing protocols typically focus on room-temperature performance metrics and fail to account for the complex interactions between cold temperatures and critical robot systems including power management, navigation,

sensors, and drive mechanisms.

SUMMARY OF THE INVENTION

[0003] The present invention provides comprehensive testing methodologies specifically designed for cold weather robot performance evaluation, including:

a) Standardized testing chambers with precision temperature control from 0°
-40°C

b) Multi-phase testing protocols measuring:

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Battery discharge rates at various temperatures

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Navigation sensor accuracy under frost conditions

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Motor torque efficiency in cold environments

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Component stress under thermal cycling

c) Automated data collection and analysis systems

d) Performance benchmark standards specific to cold storage applications

DETAILED DESCRIPTION

Testing Chamber Specifications

[0004] The testing chamber comprises:

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Dimensions: 6.0m x 6.0m x 3.0m

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Temperature range: 0°C to -40°C ($\pm 0.5^\circ\text{C}$)

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Humidity control: 20% to 90% RH

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Frost simulation capability

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Integrated tracking systems for robot movement analysis

Testing Protocols

[0005] The testing methodology includes three primary phases:

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Initial Cold Soak Testing

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24-hour temperature stabilization period

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Baseline sensor calibration

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Static systems check

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Dynamic Performance Testing

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Navigation accuracy measurement

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Obstacle avoidance in frost conditions

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Battery performance monitoring

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Motor efficiency evaluation

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Endurance Testing

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72-hour continuous operation cycles

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Thermal cycling stress tests

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Component wear analysis

CLAIMS

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A method for testing autonomous mobile robot performance in cold environments

a) Exposing the robot to controlled temperatures between 0°C and -40°C

b) Measuring navigation accuracy using standardized obstacle courses

- c) Monitoring power system performance under cold conditions
- d) Evaluating mechanical component reliability during thermal cycling

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The method of claim 1, further comprising:

- a) Automated data collection of performance metrics
- b) Comparative analysis against room-temperature baseline
- c) Stress testing of critical components

DRAWINGS

[0006] Figure 1: Testing Chamber Schematic

[0007] Figure 2: Testing Protocol Flowchart

[0008] Figure 3: Sensor Calibration Diagram

[0009] Figure 4: Performance Measurement Systems

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ASSIGNMENT

All rights, title, and interest in this patent application are assigned to Polar Dynamics Robotics, Inc., a Delaware corporation having its principal place of business at 567 Technology Park Drive, Cambridge, MA 02142.

DECLARATION

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 and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment both, under Section 1001 of Title 18 of the United States Code.

Executed on: March 15, 2022

/s/ Dr. Elena Frost

Dr. Elena Frost

CEO & Co-founder

Polar Dynamics Robotics, Inc.

