

# **POLAR ENVIRONMENT MAPPING ALGORITHM PATENT**

## **PATENT SPECIFICATION**

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

**Title: SYSTEM AND METHOD FOR ENVIRONMENTAL MAPPING**

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**Filed: March 15, 2023**

## **ABSTRACT**

A system and method for autonomous mobile robot navigation in extreme cold environments, comprising a temperature-hardened sensor array and proprietary algorithmic processing for real-time environmental mapping in sub-zero conditions. The system utilizes multi-modal sensing and machine learning to compensate for cold-induced sensor degradation while maintaining precise positional awareness and navigation capabilities in temperatures as low as -40°C.

## BACKGROUND

[0001] Autonomous mobile robots operating in cold storage and industrial environments face unique challenges related to sensor performance, battery efficiency, and navigation accuracy. Conventional mapping algorithms and environmental sensing systems experience significant degradation in extreme conditions, leading to unreliable operation and increased navigation errors.

[0002] Existing solutions fail to adequately address the combined challenges of sensor icing, reduced battery performance, and environmental mapping inaccuracies in sub-zero environments.

## SUMMARY OF THE INVENTION

[0003] The present invention provides a novel system for environmental mapping and navigation specifically designed for extreme cold conditions. The system comprises:

(a) A temperature-hardened sensor array including:

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Heated LiDAR sensors with anti-icing coating

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Redundant infrared proximity detection

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Cold-resistant inertial measurement units

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Temperature-compensated wheel encoders

(b) A proprietary environmental mapping algorithm that:

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Dynamically adjusts sensor gain based on ambient temperature

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Implements real-time sensor fusion with temperature compensation

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Utilizes machine learning for degradation prediction

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Maintains mapping accuracy in temperatures to -40°C

## DETAILED DESCRIPTION

[0004] The system employs a novel approach to environmental mapping in cold conditions through the following key components:

### Sensor Array Architecture

[0005] The temperature-hardened sensor array comprises multiple redundant sensing modalities, each protected by proprietary cold-resistant housing and featuring internal heating elements. The primary LiDAR sensor utilizes a patent-pending anti-icing coating that prevents condensation and ice formation on optical surfaces.

### Mapping Algorithm

[0006] The environmental mapping algorithm processes sensor data through

multi-stage pipeline:

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Raw data collection from sensor array

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Temperature-based calibration and compensation

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Sensor fusion and error correction

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Dynamic map generation and updates

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Path planning optimization

## **Cold Environment Compensation**

[0007] The system implements real-time temperature monitoring and compensation

through:6 -

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Continuous sensor performance monitoring

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Adaptive gain adjustment

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Predictive degradation modeling

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Automatic recalibration triggers

## **CLAIMS**

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A system for environmental mapping in sub-zero conditions comprising:

- (a) A temperature-hardened sensor array
- (b) A processing unit executing the mapping algorithm
- (c) Environmental monitoring sensors
- (d) Navigation control interfaces

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The system of claim 1, wherein the sensor array includes heated LiDAR sensors

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The system of claim 1, wherein the mapping algorithm implements dynamic

[Claims 4-20 continued...]

## **DRAWINGS**

[0008] FIG. 1 illustrates the system architecture



[0009] FIG. 2 shows the sensor array configuration

[0010] FIG. 3 depicts the algorithm processing pipeline

[Additional figures referenced but not shown]

## **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.

### **Signed:**

/s/ Elena Frost

Dr. Elena Frost, Ph.D.

CEO & Co-founder

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**Date: March 15, 2023**

## **POWER OF ATTORNEY**

The undersigned hereby appoints the registered patent attorneys and agents at  
WILSON PATENT LAW GROUP, Registration Numbers 45,678 and 56,789  
to represent the undersigned in connection with this application and transact all business in the United States Patent and  
Trademark Office connected therewith.

**Signed:**

/s/ Elena Frost

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