PATENT APPLICATION

Smart Defrosting Algorithm for External Sensors

United States Patent Application No. 17/482,391

Filed: September 15, 2023

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Attorney Docket No.: PDR-2023-IP-0391

ABSTRACT

A system and method for intelligent defrosting of external sensors on autonomous mobile robots operating in sub-zero environments. The invention comprises an adaptive algorithm that predicts ice formation patterns using environmental data and optimizes heating cycles to maintain sensor functionality while minimizing power consumption. The system utilizes machine learning to analyze temperature, humidity, and operational patterns to determine optimal defrosting timing and intensity.

BACKGROUND

[0001] Autonomous mobile robots operating in cold storage environments face significant challenges related to sensor functionality due to ice and frost accumulation. Traditional defrosting methods rely on fixed timing cycles or manual intervention, resulting in inefficient power usage and potential operational disruptions.

[0002] Existing solutions fail to account for varying environmental conditions and operational patterns, leading to either excessive energy consumption from unnecessary defrosting or compromised sensor performance due to insufficient defrosting.

SUMMARY OF THE INVENTION

[0003] The present invention provides an intelligent defrosting system comprising:

- Environmental sensor array for collecting temperature, humidity, and airflow data
- Machine learning algorithm for ice formation prediction
- Adaptive control system for optimizing defrosting cycles
- Power management module for energy efficiency optimization

- Network connectivity for system monitoring and updates

DETAILED DESCRIPTION

[0004] The system implements a novel approach to sensor defrosting through:

Predictive Analytics

[0005] The system utilizes machine learning algorithms to analyze:

- Historical temperature and humidity patterns
- Robot movement and operational schedules
- Sensor performance degradation indicators
- Environmental condition correlations

Adaptive Control

[0006] The control system features:

- Dynamic adjustment of heating elements based on predicted ice formation
- Zone-specific defrosting parameters
- Real-time sensor performance monitoring
- Energy consumption optimization

Power Management

[0007] Energy efficiency is achieved through:

- Selective activation of heating elements
- Duty cycle optimization
- Load balancing across sensor arrays
- Power consumption tracking and reporting

CLAIMS

A method for intelligent defrosting of external sensors comprising:

a) collecting environmental data from multiple sensor inputs;

b) analyzing data using machine learning algorithms to predict ice formation;

c) determining optimal defrosting timing and intensity;

d) implementing targeted heating cycles based on predictions.

The method of claim 1, wherein environmental data includes:

a) ambient temperature;

b) relative humidity;

c) air flow patterns;

d) operational schedule information.

A system for implementing the method of claim 1, comprising:

a) environmental sensor array;

b) processing unit running machine learning algorithms;

c) heating element control module;

d) power management system.

DRAWINGS

[0008] Figure 1: System Architecture Diagram

[0009] Figure 2: Control Flow Schematic

[0010] Figure 3: Sensor Array Layout

[0011] Figure 4: Power Management Module Design

DECLARATION AND POWER OF ATTORNEY

I hereby declare that:

(1) Each inventor's residence is as stated below their name;

(2) I believe the inventors named to be the original and first inventors of the subject matter which is claimed and for which a patent is sought;

(3) I acknowledge the duty to disclose information known to be material to patentability as defined in Title 37, Code of Federal Regulations, 1.56.

SIGNATURES

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