PDR-NAV-2023: COLD WEATHER PATH PLANNING PROTOCOL

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Polar Dynamics Robotics, Inc.

Effective Date: January 15, 2024

Document Version: 2.0

Classification: Confidential & Proprietary

1. PURPOSE AND SCOPE

1. This Cold Weather Path Planning Protocol ("Protocol") establishes

2. This Protocol applies to all BlueCore(TM)-enabled AMRs and asso

2. DEFINITIONS

1. "BlueCore(TM) Navigation System" means the Company's proprie

2. "Critical Temperature Threshold" means -30 C (-22 F), below whic

3. "Dynamic Path Adjustment" means real-time modification of AMR n

4. "Thermal Compensation Algorithm" means the proprietary software

3. NAVIGATION PARAMETERS

1. Temperature-Based Speed Modulation

a) Standard operating speeds shall be automatically reduced by 15%

temperature falls below -5 C

b) Additional 10% speed reduction for every 5 C decrease below -15 C

c) Maximum speed shall not exceed 1.2 meters per second below Cri

Temperature Threshold

2. Sensor Calibration Requirements

a) Thermal Compensation Algorithm must be active at all times

b) LiDAR sensor heating elements shall maintain minimum operating

-40 C

c) Ultrasonic sensor pulse timing shall be adjusted according to air de

calculations

4. PATH PLANNING ALGORITHMS

1. Cold Weather Modifications

a) Minimum turning radius increased by 20% below -10 C

b) Path overlap tolerance reduced to 150mm in freezer environments

c) Emergency stop distance extended by 25% on potentially icy surfa

2. Traffic Management

a) Minimum vehicle separation distance increased by 1.5x in sub-zero

b) Maximum concurrent AMRs in any freezer zone limited to 80% of s capacity

c) Automated re-routing triggered when temperature gradients exceed

5. SAFETY PROTOCOLS

1. Emergency Procedures

a) Automatic safe-mode activation below Critical Temperature Thresh

b) Redundant temperature monitoring through distributed sensor netw

c) Fail-safe protocols for sensor malfunction or communication loss

2. Human Interface Requirements

a) Enhanced visual and audible warnings in cold environments

b) Mandatory 2-meter minimum separation from human workers belo

c) Automatic path clearing when human presence detected in confine

6. MAINTENANCE AND MONITORING

1. System Verification

a) Hourly self-diagnostic checks of all temperature-sensitive compone

b) Daily calibration verification of all navigation sensors

c) Weekly validation of Thermal Compensation Algorithm accuracy

2. Performance Logging

a) Continuous recording of environmental conditions and system resp

b) Automated performance reports generated every 24 hours

c) Immediate notification of any deviation from specified parameters

7. COMPLIANCE AND UPDATES

1. This Protocol shall be reviewed and updated annually or upon signi

2. All updates must be approved by the Chief Robotics Officer and va

3. Compliance with this Protocol is mandatory for all Company AMR d

8. PROPRIETARY RIGHTS

1. This Protocol and all associated algorithms, methods, and procedu

2. No part of this Protocol may be disclosed to third parties without wr

9. EXECUTION

IN WITNESS WHEREOF, this Protocol has been approved and execu authorized representatives of Polar Dynamics Robotics, Inc.

APPROVED BY:

Dr. James Barrett

Chief Robotics Officer

Date: January 15, 2024

Marcus Chen

Chief Technology Officer

Date: January 15, 2024

Sarah Nordstrom

Chief Operating Officer

Date: January 15, 2024