OBSTACLE AVOIDANCE SYSTEM DESIGN SPECIFICATION

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Classification: CONFIDENTIAL - PROPRIETARY

1. OVERVIEW

This Design Specification ("Specification") documents the technical requirements and operational parameters for the Obstacle Avoidance System ("OAS") implemented in Polar Dynamics Robotics, Inc.'s ("Company") IceNav(TM)-enabled autonomous mobile robots. This document is proprietary and confidential to the Company.

2. SYSTEM ARCHITECTURE

2.1 Sensor Configuration

The OAS shall utilize the following sensor array:

- Primary LiDAR: Frost-resistant 360 scanning LiDAR (Model PDR-L360-FR)
- Secondary Sensors:
- 8x ultrasonic sensors (Model PDR-US-CT8)
- 4x infrared proximity sensors (Model PDR-IR-LP4)
- 2x stereoscopic cameras with thermal imaging capability

2.2 Processing Units

- Main Processing Unit: IceNav(TM) Core Processor (Model ICP-2024)
- Auxiliary Processing Unit: Environmental Condition Monitor (ECM-FR3)
- Dedicated Neural Processing Unit: ColdSense(TM) AI Processor

3. OPERATIONAL PARAMETERS

3.1 Detection Specifications

- Minimum Detection Range: 0.05 meters
- Maximum Detection Range: 30 meters
- Angular Resolution: 0.25 horizontal, 0.5 vertical

- Scan Rate: 40Hz at -40 C to +25 C
- Object Classification Categories: 15 distinct classes

3.2 Environmental Operating Conditions

- Temperature Range: -40 C to +25 C
- Humidity: 5% to 95% non-condensing
- Ice/Frost Resistance: Level 4 (per PDR-STD-401)
- IP Rating: IP67

4. SAFETY PROTOCOLS

4.1 Emergency Stop Conditions

The OAS shall initiate emergency stop procedures under the following conditions:

Detection of human presence within 1.5 meters

Sensor malfunction affecting more than 25% of detection coverage

Processing unit temperature exceeding specified thresholds

Communication loss between primary and auxiliary systems

4.2 Redundancy Requirements

- Minimum 3x sensor overlap for critical detection zones
- Dual-redundant processing pathways
- Independent power supplies for critical components

5. SOFTWARE INTEGRATION

5.1 IceNav(TM) Platform Integration

- Real-time sensor data fusion
- Dynamic path planning with 100ms update frequency
- Environmental condition compensation algorithms
- Thermal variation adjustment protocols

5.2 Data Logging Requirements

- Continuous logging of all sensor inputs
- 30-day retention of operational data

- Encrypted storage of safety-critical events
- Automated system health reporting

6. PERFORMANCE METRICS

6.1 Required System Performance

- False Positive Rate: <0.1%
- False Negative Rate: <0.01%
- System Latency: <50ms
- Object Classification Accuracy: >99.9%

6.2 Certification Requirements

- ISO 13849-1 PL d compliance
- IEC 61508 SIL 2 certification
- Cold Storage Safety Standard CS-2023-01 compliance

7. PROPRIETARY RIGHTS AND CONFIDENTIALITY

This Specification contains trade secrets and confidential information of Polar Dynamics Robotics, Inc. All rights, title, and interest in this Specification and the technology described herein are exclusively owned by the Company. No license or rights are granted by implication, estoppel, or otherwise.

8. REVISION CONTROL

Version	Date	Description	Approved By
3.1	2024-01-15	Updated sensor specs	J. Barrett
3.0	2023-12-01	Major revision	E. Frost
2.1	2023-09-15	Safety updates	M. Chen

9. APPROVAL

APPROVED AND ADOPTED by the undersigned authorized representatives of Polar Dynamics Robotics, Inc.

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Dr. James Barrett

Chief Robotics Officer

Date: January 15, 2024

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Marcus Chen

Chief Technology Officer

Date: January 15, 2024

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END OF SPECIFICATION