PDR-2023-112 SENSOR FUSION ALGORITHM DOCUMENTATION

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CONFIDENTIAL AND PROPRIETARY

Polar Dynamics Robotics, Inc.

Last Updated: January 11, 2024

Document Version: 3.2

1. OVERVIEW AND SCOPE

1. This documentation describes the proprietary sensor fusion algorith

2. The BlueCore(TM) Algorithms combine data from multiple sensor ty

2. INTELLECTUAL PROPERTY DECLARATION

1. The algorithms described herein are protected under U.S. Patent N

2. Additional trade secret protection applies to implementation details,

3. TECHNICAL SPECIFICATIONS

1. **Core Algorithm Components**

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Multi-modal sensor input processing

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Temperature-compensated LIDAR interpretation

Frost-resistant optical flow analysis

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Cold-optimized inertial measurement unit (IMU) integration

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Proprietary thermal drift correction

2. **Sensor Types Supported**

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Heated LIDAR arrays (Type PDR-L420)

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Cold-rated stereo cameras (Model Arctic-Cam 2.0)

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Temperature-hardened IMU (BlueCore(TM) IMU-X Series)

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Ultrasonic sensors with heated elements

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Proprietary thermal reference sensors

4. IMPLEMENTATION REQUIREMENTS

1. **Hardware Requirements**

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BlueCore(TM) Processing Unit v2.1 or later

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Minimum 8GB dedicated RAM

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Temperature-monitored sensor array

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Redundant power supply system

2. **Software Dependencies**

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BlueCore(TM) Runtime Environment v3.4.2

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Arctic Navigation Stack v2.1

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Polar Dynamics Sensor Drivers Package v4.2

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Real-time Operating System (RTOS) certification required

5. PERFORMANCE SPECIFICATIONS

1. **Operating Parameters**

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Temperature range: -40 C to +25 C

- Humidity tolerance: Up to 95% non-condensing
- Maximum navigation speed: 2.5 m/s
- Positioning accuracy: 2.5cm at -30 C

2. **System Limitations**

- Requires 3-minute warm-up period below -35 C
- Maximum continuous operation: 12 hours at extreme temperatures
- Sensor recalibration required every 2000 operating hours

6. SAFETY AND COMPLIANCE

1. The BlueCore(TM) Algorithms include built-in safety protocols comp

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ISO/TS 15066:2016 (Robots and robotic devices)

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EN 1525 (Safety of industrial trucks)

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ANSI/RIA R15.06-2012 (Industrial robots and robot systems)

2. **Emergency Protocols**

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Automatic fault detection and safe-stop procedures

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Redundant sensor checking mechanisms

Temperature-aware performance degradation handling

7. CONFIDENTIALITY AND USE RESTRICTIONS

1. This documentation contains confidential and proprietary informatio

2. No part of this documentation may be reproduced, distributed, or tr

8. WARRANTY AND DISCLAIMER

1. The Company warrants that the BlueCore(TM) Algorithms will perfo

2. THE COMPANY MAKES NO OTHER WARRANTIES, EXPRESS O

9. DOCUMENT CONTROL

1. **Version History**

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v3.2: January 11, 2024 - Current version

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v3.1: October 15, 2023 - Updated safety protocols

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v3.0: July 1, 2023 - Major algorithm revision

2. **Authorization**

This document has been reviewed and approved by:

/s/ Marcus Chen

Marcus Chen

Chief Technology Officer

Date: January 11, 2024

/s/ Dr. James Barrett

Dr. James Barrett

Chief Robotics Officer

Date: January 11, 2024

10. CONTACT INFORMATION

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