MULTI-ROBOT COORDINATION PROTOCOL SPECIFICATION

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Classification: CONFIDENTIAL

Owner: NaviFloor Robotics, Inc.

1. INTRODUCTION

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1 This Multi-Robot Coordination Protocol Specification ("Protocol") defines
- 2 This Protocol is a controlled document subject to NaviFloor Robotics' intel
2. DEFINITIONS
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1 "Coordination Zone" means any defined operational area where two or mo
2 "Fleet Controller" means NaviFloor's centralized software system that man
3 "Priority Level" means the hierarchical status assigned to each AMR task,
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4 "Safety Envelope" means the dynamic three-dimensional space surroundin

3. COORDINATION PARAMETERS

1 Spatial Parameters

a) Minimum separation distance: 1.5 meters

b) Dynamic safety envelope radius: 0.8-2.0 meters (speed-dependent)

c) Vertical clearance requirement: 0.3 meters

d) Path intersection angle threshold: 15 degrees

2 Temporal Parameters

a) Communication update frequency: 100ms

b) Path recalculation interval: 250ms

- c) Collision prediction window: 3.0 seconds
- d) Task reassignment threshold: 5.0 seconds

4. COORDINATION ALGORITHMS

1 Path Planning

- a) Primary algorithm: Modified A with dynamic constraints
- b) Secondary algorithm: Rapidly-exploring Random Trees (RRT)
- c) Fallback algorithm: Potential Field Method

2 Collision Avoidance

- a) Primary method: Velocity Obstacle approach
- b) Secondary method: Time-scaled collision cones

c) Emergency protocol: Immediate stop with graduated deceleration

5. COMMUNICATION PROTOCOLS

1 Inter-Robot Communication

a) Protocol: NaviFloor Secure Robot Communication Protocol (NSRCP)

b) Encryption: AES-256-GCM

c) Authentication: ED25519 signatures

d) Bandwidth allocation: 100 Kbps per AMR

2 Fleet Controller Communication

a) Protocol: WebSocket Secure (WSS)

b) Heartbeat interval: 50ms

- c) Reconnection attempts: 3 maximum
- d) Timeout period: 500ms

6. PRIORITY MANAGEMENT

- 1 Task Priority Levels
- a) P1: Emergency operations
- b) P2: Time-critical operations
- c) P3: Standard operations
- d) P4: Background operations

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- 2 Conflict Resolution
- a) Higher priority tasks supersede lower priority tasks

- b) Equal priority conflicts resolved by timestamp
- c) Deadlock prevention through task reassignment
- d) Maximum wait time: 30 seconds

7. SAFETY REQUIREMENTS

1 All AMRs must maintain active safety systems including:

- a) LiDAR-based obstacle detection
- b) Depth-sensing cameras
- c) Emergency stop capabilities
- d) Redundant communication systems

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2 Safety Override Conditions

- a) Loss_of_communication > 1 second
- b) Obstacle detection within 0.5 meters
- c) System fault detection
- d) Manual override signal

8. PERFORMANCE MONITORING

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- 1 Required Metrics
- a) Path efficiency ratio
- b) Collision avoidance events
- c) Task completion times
- d) Communication latency

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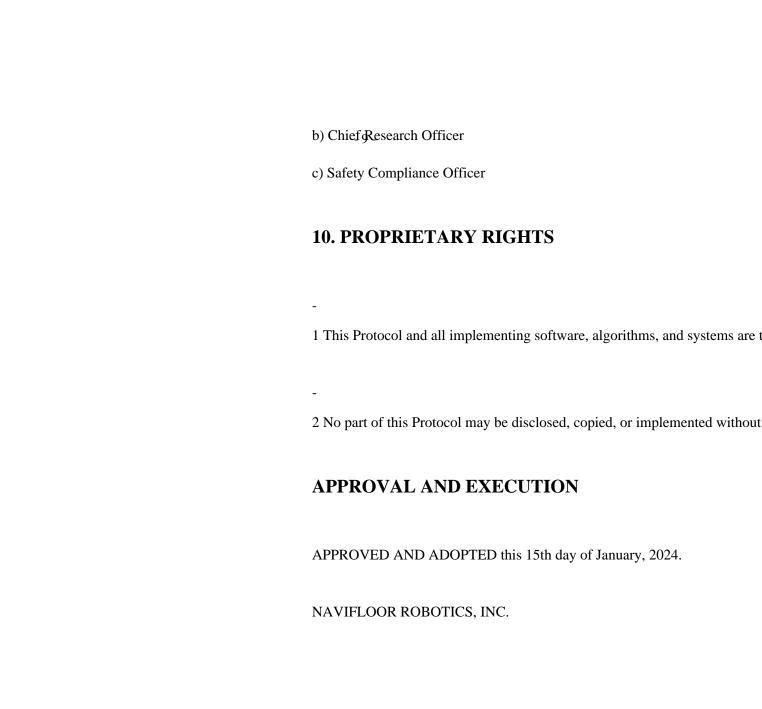
- 2 Reporting Requirements
- a) Real-time monitoring dashboard
- b) Hourly performance logs
- c) Daily summary reports
- d) Monthly trend analysis

9. COMPLIANCE AND UPDATES

1 This Protocol must be implemented in full by all NaviFloor AMR systems.

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- 2 Updates to this Protocol require approval from:
- a) Chief Technology Officer



By: -10-

Marcus Depth

Chief Technology Officer

By:

Dr. Elena Kovacs

Chief Research Officer

