BATTERY MANAGEMENT SYSTEM FOR MOBILE CLEANING ROBOTS

BATTERY MANAGEMENT SYSTEM TECHNI

EFFECTIVE DATE: January 11, 2024

DOCUMENT NUMBER: IP-BMS-2024-001

This Battery Management System Technical Specification and License Agre (the "Agreement") is made and entered into by NaviFloor Robotics, Inc., a Delaware corporation with its principal place of business at 2500 Innovation Drive, Wilmington, DE 19801 ("NaviFloor" or the "Company").

1. DEFINITIONS

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1 "Battery Management System" or "BMS" means the proprietary hardware

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2 "Licensed Technology" means all intellectual property rights, including pa

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3 "Derivative Works" means any modifications, improvements, or adaptation

2. TECHNICAL SPECIFICATIONS

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1 **System Architecture**

The BMS comprises the following core components:

(a) Central Processing Unit: STM32F767ZI microcontroller

(b) Voltage Monitoring: 24-channel analog front-end

(c) Current Sensing: Hall effect-based bidirectional current sensor

(d) Temperature Monitoring: 16-channel thermistor network

(e) Communication Interface: CAN bus with redundant channels

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2 **Operating Parameters**

The BMS is designed to operate within the following specifications:

(a) Voltage Range: 12V to 48V DC

(b) Maximum Current: 100A continuous, 150A peak

(c) Temperature Range: -20°C to +60°C

(d) Communication Speed: 500 kbps CAN bus

(e) Sample Rate: 1000 Hz for critical parameters

3. INTELLECTUAL PROPERTY RIGHTS

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1 **Ownership**

NaviFloor maintains exclusive ownership of all intellectual property rights in the BMS, including:

(a) U.S. Patent No. 11,XXX,XXX: "Dynamic Load Balancing in Mobile Rob Systems"

(b) U.S. Patent No. 11,XXX,XXX: "Predictive Battery Health Management f Autonomous Systems"

(c) All associated trade secrets and technical documentation

2 **Protection Measures**

The Company implements the following protective measures:

(a) Encrypted firmware with secure boot capability

(b) Hardware-based authentication

(c) Tamper detection mechanisms

(d) Secure over-the-air update protocols

4. IMPLEMENTATION REQUIREMENTS

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1 **Hardware Integration**

The BMS must be integrated according to the following specifications:

(a) Isolation requirements: 2500V DC minimum

(b) PCB layout guidelines per Document REF-PCB-2023-142

(c) Thermal management requirements per Document REF-THM-2023-089

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2 **Software Integration**

Software implementation must comply with:

(a) IEC 61508 SIL 2 requirements

(b) MISRA C:2012 coding guidelines

(c) NaviFloor's Software Development Life Cycle procedures

5. SAFETY AND COMPLIANCE

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1 **Safety Features**

The BMS incorporates the following safety mechanisms:

(a) Over-voltage protection

(b) Under-voltage protection

(c) Over-current protection

(d) Temperature monitoring and thermal shutdown

(e) Cell balancing

(f) Fault detection and logging

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2 **Regulatory Compliance**

The BMS is certified to meet:

(a) UL 1642 for lithium batteries

(b) IEC 62133 for secondary cells and batteries

(c) UN 38.3 for transportation requirements

(d) CE marking requirements for European markets

6. CONFIDENTIALITY

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1 All technical specifications, implementation details, and associated docume

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2 Access to BMS documentation is restricted to authorized personnel who ha

7. WARRANTY AND DISCLAIMER

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1 NaviFloor warrants that the BMS will perform substantially in accordance

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2 THE BMS IS PROVIDED "AS IS" AND NAVIFLOOR MAKES NO OTI

8. EXECUTION

IN WITNESS WHEREOF, this document has been executed by a duly autho representative of NaviFloor Robotics, Inc.

NAVIFLOOR ROBOTICS, INC.

By:

Name: Dr. Elena Kovacs

Title: Chief Research Officer

Date: January 11, 2024