METHOD FOR IDENTIFYING FLOOR SURFACE BOUNDARIES

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TECHNICAL FIELD

[001] The present disclosure relates generally to autonomous mobile robot navigation systems, and more particularly to methods and systems for identif and characterizing floor surface boundaries in industrial environments using advanced sensing and data processing techniques.

BACKGROUND

[002] Autonomous mobile robots (AMRs) operating in industrial environmen frequently encounter various floor surface types and transitions. Accurate detection and characterization of these boundaries is crucial for safe and efficient robot navigation. Existing solutions often fail to adequately address complex surface transitions, particularly in environments with multiple floor types, varying textures, and dynamic conditions.

SUMMARY

[003] The present disclosure describes methods and systems for identifying f surface boundaries using a combination of LiDAR, depth sensing, and propri signal processing algorithms. The invention enables real-time detection and classification of surface transitions while maintaining operational efficiency.

DETAILED DESCRIPTION

1. System Overview

[004] The system comprises:

a) A primary LiDAR sensor array mounted at a predetermined height;

b) Secondary depth sensors positioned at optimized angles;

c) An onboard processing unit executing the surface detection algorithm;

d) A machine learning model trained on NaviFloor's proprietary dataset.

2. Surface Detection Method

[005] The method includes the following steps:

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1 Data Acquisition

- Continuous scanning using primary LiDAR at 40Hz
- Depth sensor data collection at 60Hz
- Fusion of sensor data streams using temporal alignment

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2 Signal Processing

- Application of proprietary filtering algorithms
- Real-time surface characteristic extraction
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Pattern matching against known surface profiles

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3 Boundary Detection

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Implementation of gradient detection algorithms

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Classification of boundary types

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Confidence score calculation

3. Classification Algorithm

[006] The classification system employs:

a) Multi-layer neural network architecture

b) Real-time feature extraction

c) Surface type categorization

d) Boundary characteristic analysis

4. Implementation

[007] The method is implemented through:

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Embedded software modules

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Real-time processing capabilities

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Integration with robot control systems

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Dynamic update mechanisms

CLAIMS

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A method for identifying floor surface boundaries, comprising:

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Acquiring sensor data from multiple sources

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Processing the acquired data using proprietary algorithms

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Detecting and classifying surface transitions

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Generating navigation parameters based on detected boundaries

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The method of claim 1, wherein the sensor data includes:

- LiDAR point cloud data

- Depth sensor measurements

- Surface texture information

- Environmental condition data

- The method of claim 1, further comprising:

- Real-time surface characteristic analysis

- Dynamic boundary classification

ABSTRACT

[008] A method for identifying floor surface boundaries in industrial environments using advanced sensing and processing techniques. The metho utilizes multiple sensor inputs, including LiDAR and depth sensors, combine with proprietary algorithms to detect, classify, and characterize surface transitions. The system enables autonomous mobile robots to navigate compl industrial environments with enhanced precision and safety.

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The foregoing description is provided to enable any person skilled in the art t
make and use the described embodiments. Various modifications to these
embodiments will be readily apparent to those skilled in the art, and the
generic principles defined herein may be applied to other embodiments witho
departing from the spirit or scope of the disclosure. Thus, the present
disclosure is not intended to be limited to the embodiments shown herein but
to be accorded the widest scope consistent with the principles and novel
features disclosed herein.