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AZIMUTH ORIENTATION CALIBRATION FOR HIGH PRECISION AUTONOMOUS DEVICES

HP INC

Azimuth Orientation Calibration for High Precision Autonomous Devices

Abstract: A calibration technique that aligns the azimuth of a high-precision, autonomous device uses a point laser for each wheel and a target template to adjust the azimuth laser of the device.

This disclosure relates to the field of autonomous devices.

A calibration technique is disclosed that aligns the azimuth of high-precision, autonomous devices, such as for example autonomous printers. The process can be used for calibration both during manufacturing and in the field.

High precision autonomous devices which navigate around a working area need to be set up in the area using several control points, usually created with expensive topographic stations following a time-consuming process. Expensive, high-precision equipment is used then to verify that the device is set on the right location. However in the absence of features (e.g. columns, walls, fences, etc.) the device won't be able to navigate via a SLAM technique that builds and uses a global map of the environment to navigate. Thus there is a high risk of angular drift (i.e. angular error due to long distances to cover and slight angular offset from the starting point). This error can be minimized using a reference laser aligned with the forward axis of the device, and angular alignment can then be carried out using a reference target. However, if this laser is not perfectly aligned with the device, it will introduce another source of angular drift leading to large errors on the tasks carried out. The process of aligning the reference laser is therefore instrumental in achieving the precision required of the product, and being able to provide this calibration in a way that can be industrialized on a production line and also in the field with minimum equipment is needed.

According to the present disclosure, and as understood with reference to the Figure, a process for calibration uses a point laser press-fitted on a wheel-aligned clamp and a target template.

The point laser 10 press-fitted on a wheel-aligned clamp 20 includes a machined template jig that has a controlled datum face 30 (datum A) matching a controlled datum face 40 on the wheel 50. The point laser 10 is accurately press-fitted on the jig, therefore perpendicularity between datum A and the laser axis 60 (datum B) is tightly controlled. There is one jig for each of two wheels 50, either bolted against it or secured by clamps, magnets, or another method.

The target template 70 is a scaled template with a fixed centerline 75, and two reference lines 80 on the sides able to be adjusted on width. Designed as a multilink, each of the lateral reference lines 80 offset the same amount from the centerline 75 as the Y width is adjusted.

The process for calibration is as follows:

1. Measure the distance Y between the two wheels 50 of the device using both datums A 30 as the reference surface to be measured.

2. Install the laser jigs on each wheel 50, ensuring lasers 10 are parallel to the ground and secured. Activate the lasers 10.

3. Adjust the width on the calibration template 70 with the measured dimension Y from step 1, and place the template 70 at a distance; the longer the distance, the better the accuracy.

4. Ensure that the lateral marks 80 are aligned with the lasers 10 of both wheels 50, aligning the template 70 accordingly.

5. Activate the azimuth centerline laser 90 (the fixed laser on the device to allows its azimuth orientation), and perform the fine-adjustments of the device using fasteners to adjust the laser 90 to the left or right as required.

6. Once the azimuthal laser 90 is aligned with the centerline 75 of the template 70, secure the laser 90 by tightening the fasteners.

The disclosed technique advantageously provides accurate azimuthal orientation. It allows periodic calibrations in the field to correct any deterioration of the orientation due to vibrations, creep, damage to the unit, or other causes. It does not require high-precision and expensive calibration optical equipment.

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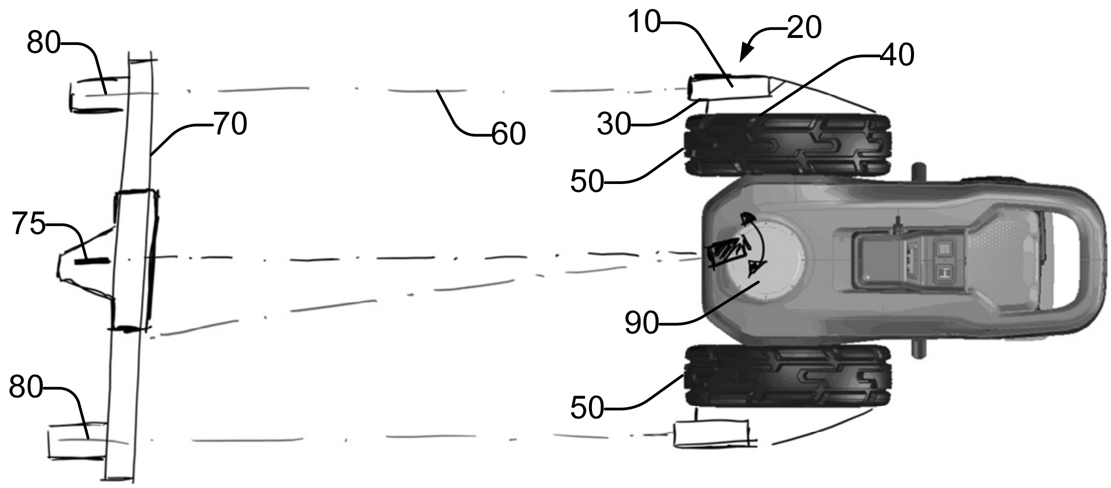
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