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Self-Calibration of 3D Sensors Installed in a Known Environment

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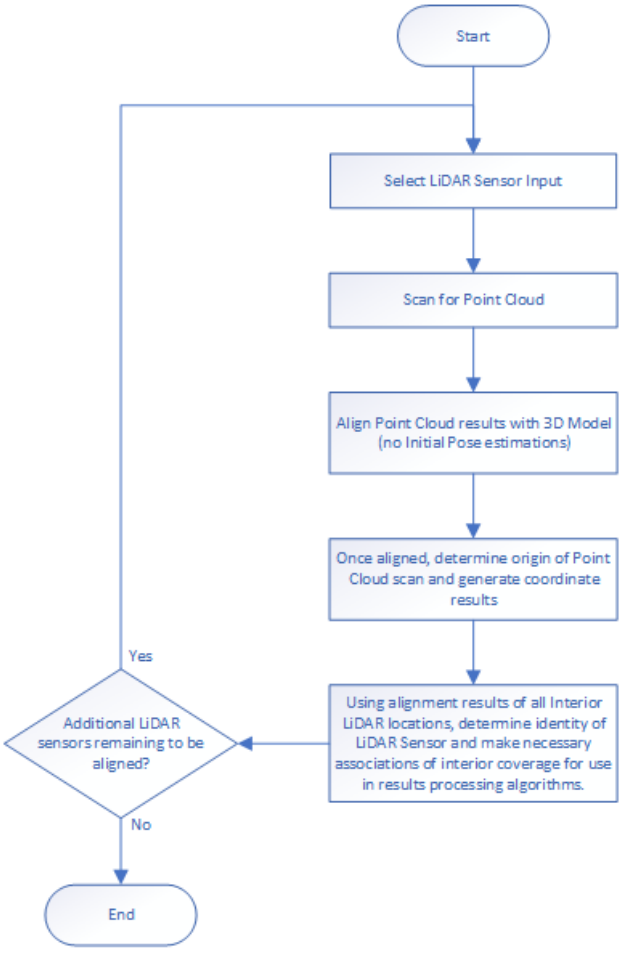
When 3D (three dimensional) sensor systems (such as Light Detection And Ranging (LiDAR)), are used, their installation location requires calibration for result processing algorithms (in LiDAR's case, the results are called a Point Cloud) to correlate the objects detected with a specific location in reference to a fixed location.

- The remainder of this publication references LiDAR, but the concept applies to any 3D scanning solution with sufficiently accurate results; Video/Still-Frame Cameras (Stereoscopic or "depth map" results), RaDAR (Radio Detection And Ranging), Ultrasound, etc.

For Automotive use cases, more than one sensor may be used. If the FoV (Field of View) of each sensor overlaps with any of the others, having this calibration becomes more important to successfully align the results to reduce the probability of detecting two or more objects in the same location. As more sensors are installed, additional time and effort is required for calibrating the sensors on different vehicle models that have unique installation points.

For vehicular passenger cabin LiDAR uses, the benefit of having a known environment detectable in the FoV of the sensor provides the opportunity for the sensors to self-calibrate.

A method is proposed to align the LiDAR Point Cloud results with a 3D model of the interior of the passenger cabin during initial operations in a default condition at vehicle assembly, or when being serviced at a qualified service center.



LiDAR Sensor Automatic Calibration

Method

The application of "Augmented Reality" (AR) 3D space processing allows for an unknown shape with an unknown pose (orientation of the shape in 3D space) detected by some sensor system, to be aligned with a known 3D model of that shape to determine its pose; the result of the pose determination is an orientation and distance relationship to the sensor.

By applying this concept, each 3D sensors' collected results can be aligned with a known model of the interior of the vehicle, only requiring some knowledge of the sensor's optical characteristics (e.g., it's FoV).

This method could be applied on the vehicle's on-board processing systems, or to expedite with more powerful processing capabilities the method could alternatively be applied on an off-board system. The off-board system could collect the appropriate 3D model from a database, collect the results from the

vehicle, and execute the calculations and write the results back into the vehicle's on-board processing systems.

Conclusion

With an automated calibration of Interior Sensing Systems, along with strategic processing algorithms that use only the calibration results to differentiate sensors, the amount of effort to develop calibrations in engineering facilities during development of each unique model with unique interiors (different seats, different steering wheels and dashboard designs, etc.) is reduced entirely.

Disclosed anonymously