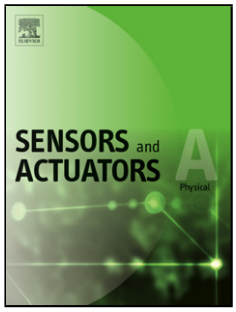

Title: An efficient vision-based pose estimation algorithm using the assistant reference planes based on the perspective projection rays

Authors: Zimiao Zhang, Shihai Zhang

PII: S0924-4247(17)31760-0
DOI: https://doi.org/10.1016/j.sna.2018.02.003
Reference: SNA 10625

To appear in: *Sensors and Actuators A*

Received date: 2-10-2017
Revised date: 28-1-2018
Accepted date: 2-2-2018

Please cite this article as: Zhang Z, Zhang S, An efficient vision-based pose estimation algorithm using the assistant reference planes based on the perspective projection rays, *Sensors and Actuators: A Physical* (2010), https://doi.org/10.1016/j.sna.2018.02.003

An efficient vision-based pose estimation algorithm using the assistant reference planes based on the perspective projection rays

Zimiao Zhang[1*], Shihai Zhang[1]

(Tianjin University of Technology and Education, Tianjin Key Laboratory of High Speed Cutting & Precision Machining, Tianjin, China, 300222[1], *zhangzimiao@qq.com)

High Lights:

- A new camera model is presented. Two assistant reference planes based on the perspective projection rays are used to describe the camera model. The mapping relationship between the image plane and two assistant reference planes are established based on the perspective projection rays.
- Four coplanar feature points are used to solve the object pose. The measurement coordinate system is established by the assistant reference planes. Each perspective projection ray is determined by two points. The two points are the intersection points of each perspective ray with the two assistant reference planes respectively. The two points could be obtained through the mapping relationship between the image plane and two assistant reference planes. In this way, the expression of each perspective projection ray is obtained. The geometrical constraints formed by the four points are then expressed with the perspective projection rays.

Abstract:

The vision-based pose estimation using feature point markers is known as the PnP (perspective-n-point) problem. Usually the pose estimation algorithms use the pinhole imaging camera model. However, the traditional pinhole calibration may generate errors. It is a perspective projection algorithm using geometrical approximations to calibrate intrinsic and extrinsic parameters. It does not consider the lens system and only gives a single lumped result for the multiple optical elements. This leads to the accuracy reduction of pose estimation. To solve the problem, the pose