A target localization method with monocular hand-eye vision

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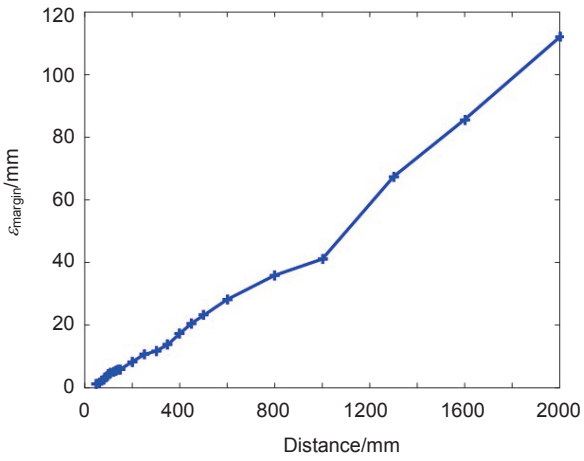

The error varies with the distance of target

Overview: Over the past decade, vision-based positioning technology has attracted more and more attentions, and has been widely used in robotics. Binocular vision is often installed at the end of a manipulator, which is used to get the position and the orientation information of targets. However, the installation of binocular vision reduces the flexibility and the load capacity of a manipulator. This problem becomes more obvious, when the load capacity of a manipulator is low or the working space is narrow. Moreover, the price of binocular vision is still relatively high. To deal with the problem above, this study puts forward a target localization method using a laser and a monocular hand-eye vision. The lower priced laser equipment used in this study can only send out a light beam, and cannot measure the distance independently. The hand-eye vision system is used to obtain the centre of the laser spot. The geometric relations among the laser emission point, light-spot and the optical axis of the camera are applied to calculate the distance from the target point to the laser emitter. The Denavit–Hartenberg convention (D–H) is often used to calculate the position and the orientation of links and joints in robotics. The distance from the target point to the laser emitter can be considered as an extended link of the manipulator. Under this assumption, the D-H method can be employed to construct the coordinate conversion system, which contains the beam of the laser and the mechanical manipulator. With this coordinate conversion system, the location of the target can be calculated. The coordinate measuring precision is negatively correlated with the distance, and it is suitable for the position measurement of medium and short distance. When a target is far away, the error is too large that it cannot work effectively. The light illuminations in the working environment have an impact on the laser spot taken by the camera. Compared with the commonly used binocular measurement methods, the proposed method uses only one camera, which reduces the width of the measurement system on manipulators, and makes it more suitable for working in narrow workspace. When searching for an object with a mobile robot, the arm is often required to enter a hole or a narrow gap. The method proposed in this paper is especially suitable for the above case. Moreover, this design also reduces the weight of the sensor on the manipulator that improves the effective load capacity of manipulators.

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