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# Vision-guided Robotic Assembly Automation

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## Abstract

This paper introduces a vision-guided alignment method with a new robot that aims at closing the gap between a manual assembly and a fully automatic assembly. It is intended to be used for assembly of small parts in a highly agile production scenario, which employs both human workers and robots in the same line, with a frequent need for reconfiguration. The proposed method is for precisely aligning assembly features on small component for small part tight tolerance assemblies which are typically found in electronic (consumer/industrial) products, by utilizing a robot guided by one or more cameras, which are oriented towards the robot and components so that the robot, components and at least a portion of the work space are within the cameras' field of view. The conventional methods of vision-guided robotics in assembly automation solutions (e.g. traditional calibration and visual servoing) cannot perform the assemblies with the grasp error and visually inaccessible assembly features. The is vision-guided alignment system that utilizes a camera space manipulation control process, on the other hand, relies on the CAD model of the components with a local calibration method (i.e. camera space manipulation) to achieve the high accuracy alignment for the final assembly. This method reduces costs for small part assembly due to the elimination of complicated high accuracy robot calibration, expensive vision system calibration patterns and high-speed image processing requirements. It also promises to be very easy to use and reliable for these applications due to the features of automatically initializing the camera space kinematic model and compensation of the part grasp error in local model. Under two cameras configuration, the developed 3D vision guided assembly robot system successfully assembly the ideal parts within sub-millimeter tolerance with no manual calibration.