

## Visual and Chemical Servoing of a Hexapod Robot in a Confined Environment Using Jacobian Estimator

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**Abstract :** Industrial inspection can be achieved through robotic systems, allowing visual and chemical servoing. A popular scheme for visual servo-controlled robotic is the image-based servoing systems. In this paper, an approach of visual and chemical servoing of a hexapod robot using a visual and chemical Jacobian matrix are proposed. The basic idea behind the visual Jacobian matrix is modeling the differential relationship between the camera system and the robotic control system to detect and track accurately points of interest in confined environments. This approach allows the robot to easily detect and navigates to the QR code or seeks a gas source localization using surge cast algorithm. To track the QR code target, a visual servoing based on Jacobian matrix is used. For chemical servoing, three gas sensors are embedded on the hexapod. A Jacobian matrix applied to the gas concentration measurements allows estimating the direction of the main gas source. The effectiveness of the proposed scheme is first demonstrated on simulation. Finally, a hexapod prototype is designed and built and the experimental validation of the approach is presented and discussed.

**Keywords :** chemical servoing, hexapod robot, Jacobian matrix, visual servoing, navigation

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