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# Autonomous Ground Vehicle Navigation Based on a Single Camera and Image Processing Methods

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**Abstract :** A vision system-based navigation for autonomous ground vehicle (AGV) equipped with a single camera in an indoor environment is presented. A proposed navigation algorithm has been utilized to detect obstacles represented by coloured mini-cones placed in different positions inside a corridor. For the recognition of the relative position and orientation of the AGV to the coloured mini cones, the features of the corridor structure are extracted using a single camera vision system. The relative position, the offset distance and steering angle of the AGV from the coloured mini-cones are derived from the simple corridor geometry to obtain a mapped environment in real world coordinates. The corridor is first captured as an image using the single camera. Hence, image processing functions are then performed to identify the existence of the cones within the environment. Using a bounding box surrounding each cone allows to identify the locations of cones in a pixel coordinate system. Thus, by matching the mapped and pixel coordinates using a projection transformation matrix, the real offset distances between the camera and obstacles are obtained. Real time experiments in an indoor environment are carried out with a wheeled AGV in order to demonstrate the validity and the effectiveness of the proposed algorithm.

**Keywords :** autonomous ground vehicle, navigation, obstacle avoidance, vision system, single camera, image processing, ultrasonic sensor
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