

Design and Development of Stereoscopic Vision Based Obstacle Detection Algorithm for Driver Assistance System



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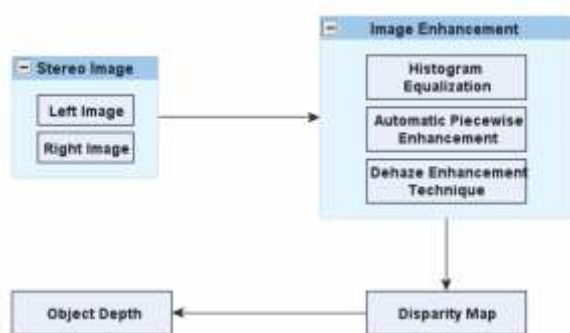
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Abstract:

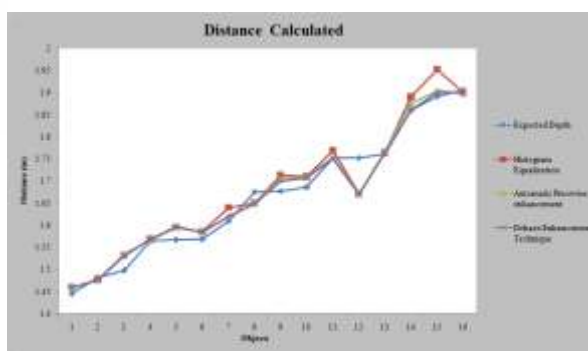
Obstacle detection and collision avoidance is one of the important subsystems of driver assistance system. Stereo vision camera system is used for obstacle detection and ranging in day light conditions. However during night time conditions the disparity map derived from stereo images are not reliable due to the poor visibility and contrast of the images. Hence stereo infrared camera system or fusion system involving camera combined with RADAR or LIDAR is preferred for night conditions increasing system complexity.

In this work, use of stereo vision camera system is proposed for both day and night time conditions. In order to use stereo vision camera for night time detection, enhancement techniques are proposed to improve the visibility and contrast of the images before depth calculation. Three enhancement techniques – histogram equalization, automatic piecewise enhancement and dehaze technique are explored in this aspect. Use of enhancement technique on low light images will result in improved image contrast and clear distinction between foreground and background of the image. The impact of the enhancement technique on low light is studied by analysing the disparity map and the resulting depth calculation.

Simulations are carried out in MATLAB using the stereo database images and uniform low light image model for night time conditions. Simulation results indicate that the use of enhancement technique on low light images has resulted in clear distinction between foreground and background resulting in the depth calculation closer to the ground truth depths. The lower error in depth calculation less than 2%, indicates that stereo vision camera system with enhancement techniques can be used for obstacle detection and ranging for driver assistance under all lighting conditions. Further evaluation of the algorithm is required using improved low light image model and real data with on-road scenarios during night time conditions.



Overall system implementation



Depth calculated for low light stereo images