Simultaneous Localization and Mapping for Unmanned Vehicles Using Photo Montage

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ABSTRACT:

A photographic montage is assembled from images acquired by compact, low-cost cameras mounted on unmanned vehicles (UVs).

In one application, a robot inside an unfamiliar building finds its own position by creating a photomontage of the ceiling from an upward-looking on-board camera. Once the photomontage is complete, it is used by the robot as a map. Self-localization is accomplished by recognizing the ceiling view. Odometry gives a rough estimate of position as a starting guess to speed the recognition process. A ceiling view has the advantage over a floor view for two reasons. Firstly, the robot-to-ceiling distance is greater than the robot-to-floor distance minimizing image distortion. Secondly, the ceiling is far more likely than the floor to be obstacle free. Other sensors such as laser or sonar on the robot can be used to map floor-level objects.

In a similar application, the process can be used to create an image of the underside of a car or truck in the search for explosives or contraband.

In another application, a forward-looking camera is mounted on an unmanned aerial vehicle (UAV) for reconnaissance. To ease the interpretation of this reconnaissance video, particularly when multiple vehicles collaborate on the mission, it is desirable to create an image mosaic of the desired area. Aircraft position and orientation is known, but images from multiple aircraft must be combined optimally. This image can then be draped over the elevation datum to create a three dimensional model of the terrain.

KEYWORDS: Unmanned Vehicle, Mapping, Localization, Robot, Photo Mosaic

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