

Sensors

Super Resolution 3D Flash LIDAR

Real-time algorithm producing 1M pixels or greater 3D image frames

NASA Langley Research Center has developed 3-D imaging technologies (Flash LIDAR) for real-time terrain mapping and synthetic vision-based navigation. To take advantage of the information inherent in a sequence of 3-D images acquired at video rates, NASA Langley has also developed an embedded image processing algorithm that can simultaneously correct, enhance, and derive relative motion, by processing this image sequence into a high resolution 3-D synthetic image. Traditional scanning LIDAR techniques generate an image frame by raster scanning an image one laser pulse per pixel at a time, whereas Flash LIDAR acquires an image much like an ordinary camera, generating an image using a single laser pulse. The benefits of the Flash LIDAR technique and the corresponding image to image processing enable autonomous vision based guidance and control for robotic systems. The current algorithm offers up to eight times image resolution enhancement and well as a 6 degree of freedom state vector of motion in the image frame.

BENEFITS

- ➔ Improved spatial resolution of 3D flash LIDAR video images by a factor of 8 times
- ➔ Provides platform relative position and attitude angles
- ➔ Desirable video processing speeds and high speed data rates

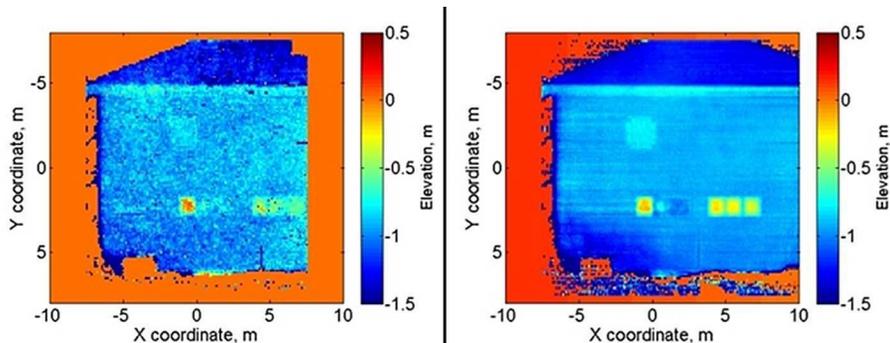
APPLICATIONS

- ➔ Precision safe spacecraft landing
- ➔ Automatic spacecraft rendezvous and docking
- ➔ Autonomous rover and robot guidance and control
- ➔ On-orbit inspection and servicing
- ➔ Robotic ground vehicles collision avoidance and mobility operations
- ➔ Topographical/terrain mapping
- ➔ Automotive collision avoidance, adaptive cruise control, situational awareness

technology solution

THE TECHNOLOGY

This suite of technologies includes a method, algorithms, and computer processing techniques to provide for image photometric correction and resolution enhancement at video rates (30 frames per second). This 3D (2D spatial and range) resolution enhancement uses the spatial and range information contained in each image frame, in conjunction with a sequence of overlapping or persistent images, to simultaneously enhance the spatial resolution and range and photometric accuracies. In other words, the technologies allows for generating an elevation (3D) map of a targeted area (e.g., terrain) with much enhanced resolution by blending consecutive camera image frames. The degree of image resolution enhancement increases with the number of acquired frames.



Original (left) and enhanced resolution flash LIDAR image (right)

PUBLICATIONS

Patent No: 8,655,513; 8,494,687

Patent Pending

National Aeronautics and Space Administration

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