

Real-Time Full-Field 3D Shape Measurement

Background

Structured lighting optical methods have been commonly used for non-contacting 3D object-shape measurement. A known light pattern, stripe, grid, or more complex shape is projected onto an object, and the 3D coordinates of points on the object surface can be calculated by triangulation from images acquired by a camera from another direction.

Point-by-point and line-by-line techniques require the projected light to be moved across the object surface to acquire the full surface-geometry information. These approaches are slow and not practical for real-time applications.

Description of the invention

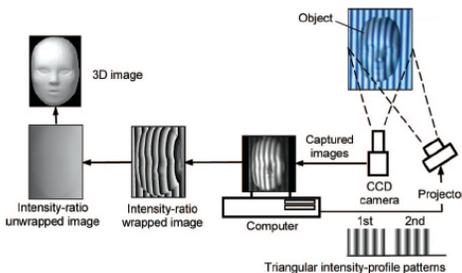
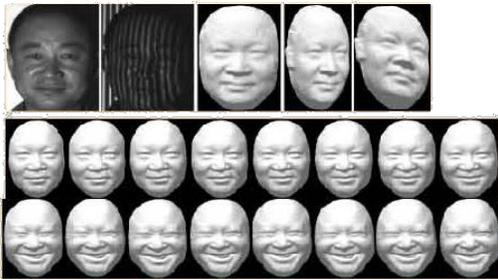
The University of Waterloo has developed a real-time full-field 3D shape measurement system that uses a novel high-speed triangular-pattern phase-shifting method of 3D surface-geometry measurement. This system can instantly produce a full-field 3D image, generating a 3D coordinate at every image pixel. The system can also acquire a sequence of 3D images in real-time of a deforming surface.

Advantages

Compared with the traditional methods, the new method requires fewer images to acquire a 3D image and the computation is simpler. This offers a faster 3D image processing speed which is suitable for real-time 3D object measurement of deforming surfaces.

Potential applications

This technology is applicable to a variety of applications including 3D surface visual inspection, manufacturing and on-line quality control, preventive maintenance, entertainment, security and surveillance (e.g. biometrics), prosthetics, orthotics-braces, medical reconstructive surgery, forensics, archaeology, agriculture, food processing industry, reverse engineering, custom fitting, body motion monitoring, and body fitness. The technology has particular advantages for 3D facial motion capture in animation and film applications, and also in facial surface analysis – deception analysis.



Full-Field 3-D Shape Measurement setup

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Stage of development

Working prototype

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