



Three Dimensional Surface Temperature Measurement System

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In this paper, the three-dimensional surface shape measurement system with the temperature information is introduced. The measurement is established using a three-dimensional surface measurement system and a thermography. The measurement system is composed of CCD camera, a laser and thermography. The laser is projected to the object and the laser streak image appeared on the surface of the object is observed by a CCD camera and thermography. The streak image recorded by the CCD camera is used to reconstruct the object shape on a computer, and the corresponding temperature data obtained by a thermography is allocated to the reconstructed surfaces of the object on a computer.

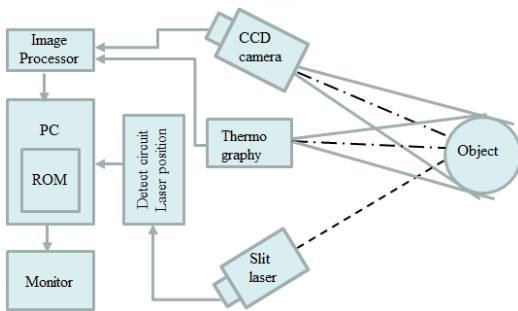


Fig.1 Measurement system

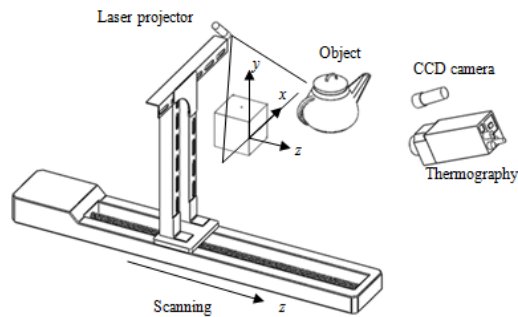


Fig.4 the calibration setup

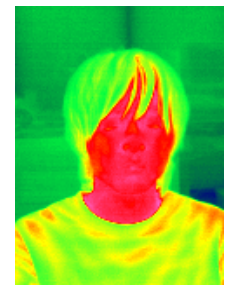


Fig.7 Thermal image (2D)

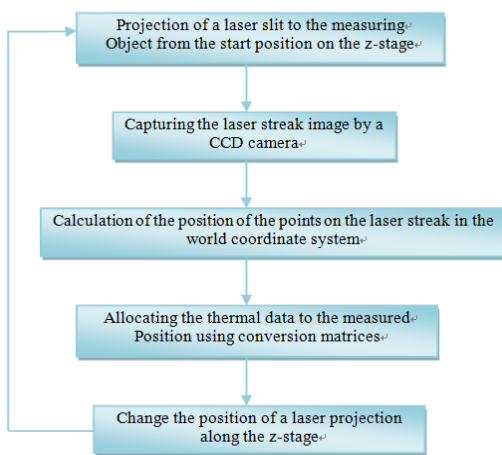


Fig.2 Flow of the measurement

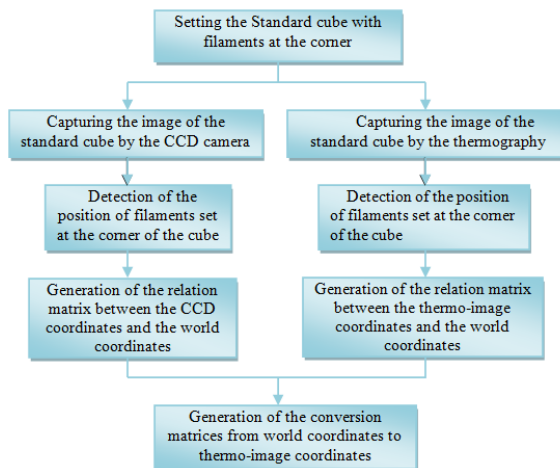
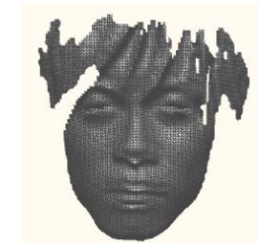
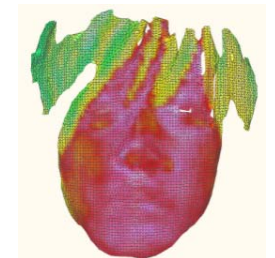


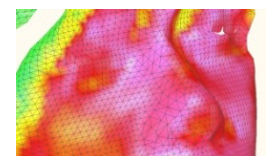
Fig.5 Flow of the calibration procedure



(a)Reconstructed human face



(b)The 3D thermal image



(c) Magnified human face

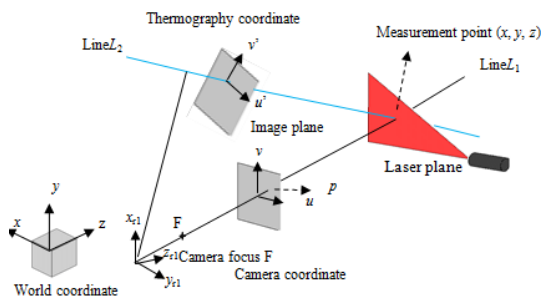


Fig.3 the relation between camera coordinate system and world coordinate system

A measurement point is located as the intersection between the laser plane and the straight line from a camera focus

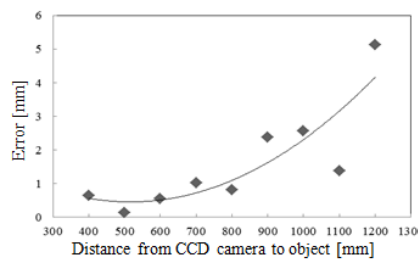


Fig.6 Measurement accuracy

The system measures the 3D shape of the object and the surface temperature of the object is allocated simultaneously on the computer. The obtained data can be used for a quantitative analysis of a heat radiation considering the area and the roughness of the heat source object.

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Fig.8 Measurement result