

Mass Personalized Design based on 3D Parametric Modeling of Human Faces

Personalized design is a major trend in modern consumer products. A critical issue in realizing personalized design is to differentiate product or service designs according to individual features or requirements. Consumers select products related to human faces such as the glasses frame, wearing accessory, and wigs based on whether the product fits the person wearing it. The product design thus needs to be conducted in a human centric manner. Current computer aided design (CAD) technologies are not developed from the user perspective and do not support integration of multi-media or non-engineering data. Virtual reality and augmented reality (AR/AR) provide a better environment for interacting with users, but they do not allow instant change of objects in the environment. To overcome those deficiencies, this research aims to develop innovative personalized design functions for products or services related to human faces, by integrating 3D anthropometry, parametric design, image processing, and computer graphics. We first expand facial anthropometry database of Taiwanese people. 3D parametric facial models will be constructed using principal component analysis, across parameterization, and Kriging methods. Facial features of a user are identified from the depth and image data captured by a portable RGB-D sensing device. With the feature data, the parametric model produces a mesh model approximating to the user face. Highly realistic visual effects are produced by texture mapping techniques with an image taken from the user. The facial model thus re-constructed serves as an effective reference for personalized design. In addition, an advanced user interface will be developed to facilitate 3D manipulation and instant interaction with the face model. The interface provides synchronized visual and tactile senses by integrating a 5-DOF haptic device. A prototype system will be implemented based on the concept of personalized virtual face make up. The system also demonstrates practical values of this work. This research realizes the concept of human centric mass personalized design. The research outcomes will open up design methods in the cosmetics and cosmetic surgery industries.

Keywords: *personalized design, 3D face model, depth sensing, haptic device, virtual prototyping*