Augmented Reality based Personalized Shoes Design

Personalized design is a major trend in modern product development. The most critical issue is to understand individual differences of consumer requirements and to co-create values with consumers. In addition to functional requirements, wearing products emphasize on demonstration of personal tastes and styles of users. It is a key factor whether the product design matches well with the user wearing it. Such products have a strong need of personalized design. On the other hand, augmented reality provides a superior environment for human computer interaction. Human sensing technologies have recently made significant progresses. Both technologies help realize the concept of human centric design. Therefore, this research will conduct a cross-disciplinary study, which integrates various knowledge in engineering, design, and ICT. This study will combine computer vision, computer graphics, free form deformation, product modularization, and human computer interaction technologies. Our goal is to develop a novel method of personalized shoes design with augmented reality. This method consists of two kernel functions: virtual shoes try-on and real-time adjustment of shoes appearance. Kinect^{TM} will be used to continuously capture the video and depth information of real scenes. A multi-stage algorithm that applies marker, markerless tracking, and video smoothening techniques will be constructed for real-time tracking of human foot in motion. A virtual shoe model will be precisely positioned in the video stream of a human foot, thus realizing a virtual shoes try-one process with realistic visualization quality. In addition, a generalized shoe model is decomposed into three modules: shoe cloth, shoe surface, and shoe bottom. We provide customization functions for each module with design attributes including color, material, texture, and dimensions. Shoe models constructed from their corresponding shoe lasts serve as training data for constructing a parametric design method. This method allows free form deformation of single components in an assembly product while maintaining the assembly relationships among the components. In conclusion, this research implements the concept of mass design personalization. It provides wearing products an innovative human-centric design approach. In technical merits, we will develop a multi-stage high performance algorithm for dynamic tracking and positioning of human foot in motion. A new method driven by general regression neural network will be proposed for free form deformation of an assembly product in mesh model. It is expected that the results produced by this work will lead to a series of new topics with applications of advanced ICT on human centric design.

Keywords: augmented reality, personalized design, object tracking, mesh deformation, human sensing