INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

Name of the Student : HAILU GEBRETSADIK TEKLEMARIAM
Roll Number : 126105008
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Thesis Title:
"Evaluation of virtual product and usability of haptic feedback systems (A case study Phantom Omni force feedback device)"

Name of Thesis Supervisor(s) : Prof. Amarendra. Kumar Das
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SHORT ABSTRACT

Research towards a methodology which helps designers/engineers in conceptualizing, facilitating participatory design and validating products during designing and development process becoming more important with the aim of reducing the lengthy process and errors that crops up during the process. It has also been realized today's technology is having more influence in education than it had earlier. Although, during product design and development products virtually prototyped in CAD environment is being realized through rapid prototyping and tooling, but it is felt that in absence of sensual/haptic feeling and perception of size, form in CAD prior to rapid prototyping; products realized still require modification. In this kind of situation, it is felt that virtual reality-haptic is among the solutions to cater repeated physical prototyping as well as for rapid prototyping and reduces related cost. This integrated system of virtual reality-haptic feedback interaction may enhance the usability evaluation of virtual products by replacing the physical mockups with digital mockup thereby reducing the development time and the costs of product design.Therefore, emphasis of this research was to evaluate the usability of phantom Omni force feedback device towards perception of the products shape, depth, texture, and weight. During this process it was attempted to study the virtual and augmented reality, haptics working principles and their advantage towards product evaluation using phantom Omni force feedback device. Through this study it was possible to understand the working principles of haptic device and write codes/program using OpenHaptics software development toolkit in order to manipulate the virtual object which was prepared

through CAD software (in this research CATIA was used), thereafter, experimental setup with full system were established. After preparing questionnaires and virtual reality-haptic system, participants were allowed to manipulate the virtual object via phantom Omni haptic feedback device and compare the physical properties of different virtual objects. Finally collected data were analyzed and drawn a result that revealed the potential of virtual reality-haptic system for realizing the virtual objects surface texture, size, shape, and weight. But, as the participants revealed on their feedback the stylus of the haptic devices were not comfortable and caused pain during weight perception and attempt has been made to change the stylus considering the standard gripping dimension and finally experiment conducted to evaluate the final version of the stylus.