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Abstract

Virtual reality (VR) can be considered as the use of various computer graphics systems in combination with various displays and interface devices to provide the effect of immersion in an interactive three-dimensional computer-generated environment. The interaction between the user and the virtual environment is basically limited to the three sensory modalities of vision, tactile sensing and audio. VR has led to many researches for many years, to improve the technologies especially in medical surgical training simulation.

The main objective of this research project is to develop a simple surgical training simulation on laparoscopic cholecystectomy by using the low end PC-based system. The software system was developed by "WorldToolKit" from Sense 8 Corporation in order to allow a surgeon to perform surgical training. This simulation concerns on the manipulation of the surgical tools to perform the basic techniques such as cutting and grabbing on the cystic duct at the gallbladder. Besides that, collision management also becomes a main concern in this project.

In order to prove the validity of the system, it was tested on the collision detection and collision response between the virtual tools and the skin of the cystic duct. This response includes the visual and audio feedback and message prompt to acknowledge the user regarding the current status of the simulation. Method for grabbing and cutting also had been discussed in this project. Finally, this research also includes the testing on the effect of the complexity of the environment to the smoothes of the tool's movement. Besides, the comparison between existing cutting method and new method had been analyzed. Conclusion is provided based on the result produced.

Deficiencies and future enhancements of the system also had been discussed to improve the features of virtual surgical environment especially on the complexity of the fulcrum effect and force feedback on the simulation.

Abstrak

Realiti Maya boleh dikatakan sebagai penggunaan sistem komputer grafik yang mempunyai kombinasi pelbagai paparan dan alat permukaan dalam menghasilkan kesan kerendaman dalam suasana penghasilan komputer tiga dimensi yang interaktif. Pada asasnya, interaksi di antara pengguna dan suasana maya dihadkan kepada tiga model pengesan iaitu visi, percepsi pengesanan dan audio. Penyelidikan realiti maya telah bermula sejak beberapa tahum yang lalu demi mempertingkatkan teknologi terutamanya dalam kursus simulasi pembedahan bagi bidang perubatan.

Objektif utama penyelidikan yang dijalankan dalam projek ini adalah untuk membina satu kursus simulasi pembedahan yang mudah terhadap "laparoscopic cholecystestomy" dengan hanya menggunakan sistem komputer yang kurang canggih. Sistem perisian ini dihasilkan melalui "WorldToolKit" daripada Sense 8 Corporation demi membenarkan pembedah melakukan latihan pembedahan. Simulasi ini menitikberatkan manipulasi terhadap alat-alat pembedahan demi menjalankan teknik-teknik asas seperti pemotongan dan genggaman ke atas duktus sista pundi hempedu. Selain daripada itu, projek ini juga memberi tumpuan kepada pengurusan perlanggaran.

Demi membuktikan kesahihan sistem tersebut, ia telah diuji ke atas pengesanan perlanggaran dan aksi perlanggaran di antara alat-alat maya dan kulit duktus sista. Aksi ini merangkumi maklum balas dari segi visual dan audio serta prom mesej untuk tanggapan pengguna terhadap keadaan simulasi pada ketika itu. Cara-cara untuk genggaman dan pemotongan juga dibincang dalam projeck ini. Akhir sekali, penyelidikan ini juga merangkumi ujian terhadap kesan daripada

suasana yang kompleks terhadap kelancaran pergerakan pada peralatan yang digunakan. Selain daripada itu, perbandingan di antara cara permotongan yang setia ada dan cara permotongan yang dicadangkan telah dijalankan. Ksimpulan juga dirumuskan berdasarkan kepada keputusan yang telah dianalisa.

Kekebalan dan pembaharuan masa depan terhadap sistem ini juga telah dibincangkan untuk mempertingkatkan ciri-ciri terhadap suasana pembedahan yang maya terutamanya pada kerumitan dalam pengesanan pangsi dan maklum balas tekanan dalam simulasi.

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