Virtual Reality Combat Trainer

Changkuan Zhuang1,*, Yuxin Zhuang2 and Sindy Yang Liu3

1Hainan Normal University, China
2Beijing University of traditional Chinese medicine, China
3Melbourne University, Australia

*Corresponding author email: zck1717117@126.com

Abstract. This research reveals a system that can support combat training and games, in order to enable the combat enthusiasts who have not been trained professionally to carry out actual combat training and experience. On the basis of ensuring the safety, this study describes the virtual combat trainer from the perspective of enhancing the actual combat experience. It also describes the meaning, function, technical principle, technical characteristics and innovation of the product. This research is mainly used in martial arts fighting training, competition and other aspects.

Keywords: Virtual reality; Combat; Training.

1. Product Significance
The virtual training method is used to reduce the training threshold of combat sparring, and realize real-time, complete and comprehensive sparring through safe and low-cost means. Let the trainees experience the sense of presence and immersion in combat. Under the premise of no physical injury risk, let the trainees fully get the accumulation of actual combat experience, and through the analysis of combat data, scientifically and rigorously analyze each combat tactics and implementation effect.

The purpose of this study is to promote the development of fighting sports by using virtual reality equipment and virtual fighting software. It is hoped that practitioners can cultivate their interest and gain deep understanding in combat sports by using this immersive technology.

2. Product Function
Through the use of virtual reality technology as a means, practitioners carry out the course of martial arts combat actual combat training, so that trainees can experience realistic combat without physical injury, experience the fun of combat and get valuable practical experience. At the same time, through experimental teaching methods, trainees can improve their ability of self summary, self analysis, tactical communication and self-awareness.

The implementation process includes the virtual fighting in groups and the real-time observation of the rest. It also helps to analyze the tactics after the match, so that the trainees can not only experience the virtual combat, but also promote the communication and analysis between the trainees.

3. Technical Principle
Based on the unique characteristics of virtual environment, the sensory stimulation and the possibility of physical injury stripping were studied

3.1 make use of the sensory stimulation of virtual reality to improve the interest of physical training, reduce the psychological resistance of trainees to training in essence, and increase their desire for training.
3.2 make use of the action capture function of virtual reality equipment to count all training results of trainees. The data mainly include attack strength index, attack speed index, attack frequency index, attack type statistics, and the number of related body movements completed.

3.3 using the uniqueness of virtual reality, trainees are allowed to carry out combat training close to the actual combat effect without physical injury. This feature means that many competition rules imposed in the real fight competition can be opened, such as: can't hit the back brain, can't hit the crotch, etc., can be unlimited close to the real fight.

3.4 data monitoring and statistics throughout the competition. At the end of the whole competition, the main technical features are announced through the display, and various command requirements are realized.

### 4. Main Technical Features

The virtual battle rules are set, mainly including the following indicators

4.1. Alignment of virtual and real ring sizes

4.2 The duel time is set as: n rounds and N minutes, n minutes rest time between each round, The competition system is 1-to-1 combat. There's no limit to the hit parts and moves.

4.3 The "physical strength points" set for each virtual role operated by each trainee is n (100%), which will be reduced when receiving the attack. When the physical strength point is 0, the virtual character is considered to be knocked down. After five seconds, stand up again and reset the fitness points to n * 0.5 (50%). If knocked down again, stand up again after five seconds, and reset the physical points to n * 0.25 (25%). (the five second time is an adjustable non fixed time, and the winning side's "fitness point is n").

4.4 Trainees can perform martial arts through the hand motion capture device of virtual reality equipment. When the next fight successfully falls on the virtual character of the opponent, it will cause damage. The damage is obtained by applying the relevant physical formula to the fist swing distance and speed.

4.5 The winning and losing criteria of each round are:

10-9: when both sides are knocked down for the same number of times, the blood volume is 10% more.
10-8: the party who has been knocked down less times will get 10 points.
10-7: if there is a difference of 3 or more knocks between the two sides, 10 points will be given if the two sides are knocked down less.

4.6 Virtual boxing size is aligned with real boxing size.

4.7 The duration of the duel is set as: three games, three minutes, one minute rest time between each game.

4.8 The "physical points" of virtual role operated by each trainee is set as 3000 (100%), which will be reduced correspondingly after being attacked. When the physical points are 0, the virtual role is regarded as being knocked down. After five seconds, stand up again and reset the physical points to 1500 (50%). If it is knocked down again, stand up again after 5 temples and reset the physical points to 750 (25%).

### 5. Main Innovation Points

Through virtual reality equipment and hand motion capture equipment, practitioners can perform martial arts. When the next fight successfully falls on the virtual character of the opponent, the system confirms that there is damage. The damage is obtained according to the fist swing distance and speed, and according to the relevant physical formula. After training, the indexes of training appear immediately.

### 6. Conclusion

This research product is mainly used in martial arts training, performance professional athletes simulation fighting practice. In particular, the application of actual combat is a martial arts instrument that can really solve the safety problem, and it opens a door for martial arts fighting projects to enter the society. And make it possible to carry out martial arts fighting in an all-round way.
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Introduction to the first author: Zhuang Changkuan (1976 -), male, Professor of Hainan Normal University, Postgraduate Tutor.

Main research direction: martial arts, Taekwondo Teaching and training; sports new technology product research and development and promotion of new projects.

Address: Hainan Normal University, No. 99, Longkun South Road, Qiongshan District, Haikou, Hainan Province.

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