

DESIGNING A MEASUREMENT SYSTEM FOR TAEKWONDO TRAINING

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INTRODUCTION

Attacking speed and force are both important factors for Taekwondo (TKD) competition (Pain, 2006). A real time feedback instrumentation to determine TKD player's attack speed and force is very useful for training. Thus, the intent of this research was to design a measurement system which can detect the speed and force in every kick. In this system, an air bag was set inside the target board to measure the kicked force and two sets of electric photo sensors were set in front of the target to measure the kicked speed. Besides, the system was assembled with a single chip for A/D converting and auto calculating player's kick speed and force from his roundhouse kick (RK) and back kick (BK). Finally, the attacking speed and force for kicks were experiment successfully on real-time by 3 subjects. So, this system will more useful to detect players' attacking speed and force for TKD training in the future.

METHODS

One was the designing of kick speed (km/ hr). It was a kinematics measurement under two sets of photoelectric switch those recorded the time-position during foot passed period. Also, the passing signal was transmitted to the micro-computer (Fig.1). The other was the designing of kick force (kgf) collection. When one kicked his foot on the air bag, the air pressed into pipe distal pressure sensor and then the analog pressure signal was amplified and transmitted to the single chip micro computer (PSoC CY8C27443) which converted A/D and auto calculating the digital signals (Fig.1). Then we use algorithm to read data and display it on the monitor.

controlled the voltage between 0~5V since signal value was pretty small. This experiment introduces 5 points calibration method sketching the relationship between force and voltage (Fig.2).

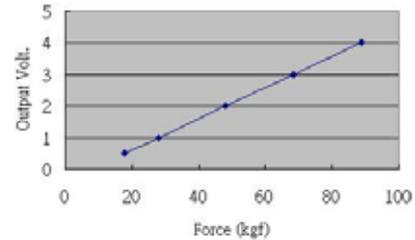


Fig. 2 The calibration of voltage-force

Three subjects kicked the target board of the system. Experiment location was in the laboratory. Each subject needed to perform a roundhouse kick (RK) and a back kick (BK) on the target board. After attacking the target board, the data of the attacking speed and force was displayed on the monitor immediately.

RESULTS AND DISCUSSION

Subjects need to use roundhouse kick (RK) and back kick (BK) in this system. The system starts measuring speed and force of roundhouse kick (RK) or back kicks (BK), when the start button is pressed. Finally, the system shows speed and force on the monitor. Data from both kicking movements, on attacking speed and force are shown in Table 1. In the table, we can see the attacking force of subject which kicked faster is larger than the subject which kicked slower. Both RK and BK have the same phenomenon. After both kicking movements, all data of the attacking speed and force were shown in Table 1.

Table 1: The data of attacking speed and force

Subjects	RK		BK	
	Speed (KPH)	Force (kgf)	Speed (KPH)	Force (kgf)
A	80.2	78.9	78.9	72.1
B	82.3	80.9	88.9	87.5
C	90.9	92.5	85.7	85.7

CONCLUSIONS

This new real-time measurement system can be used to determine the attacking speed and force of TKD movements. This system can be applied for training TKD athletes and also for other combative sports such as Karate and Boxing in the future. This new design machine can be reformed its outer looking to be a commercial use for the instant feedback.

REFERENCES

1. Roosen. A, Pain. M.T.G. (2006), Impact timing and stretch in relation to foot velocity in a taekwondo kicking combination, *Journal of Biomechanics*, 39, S562.

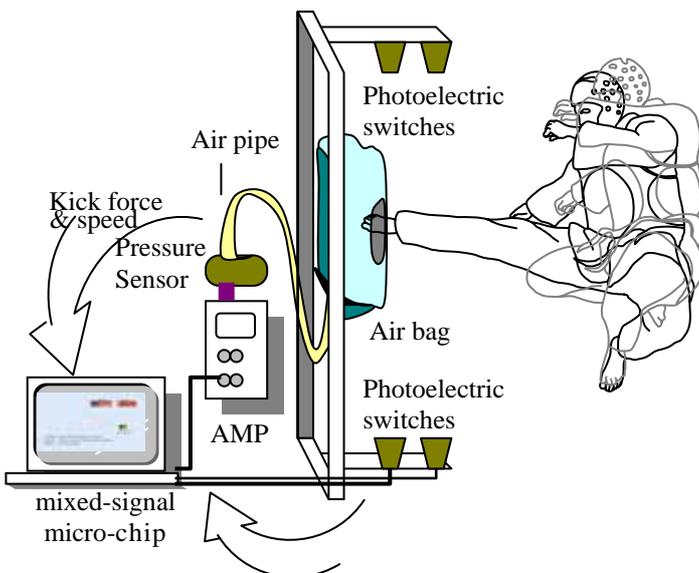


Fig.1 The illustration of whole system structure

With analog signal transmitted by the constant current, the internal structure of pressure sensor was formed by the "Wheatstone bridge". It was meant that we put pressure on SCC05DN pressure sensor, the resistance changed. Furthermore, we connected it to the magnified circuit and