Chagi Test Design for Taekwondo Student

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Abstract

Nowadays, kick test in Taekwondo is conducted manually with stopwatch and cannot be taken independently. Therefore, the purpose of this study is to design and create Chagi test device which can measure the kick speed, accuracy and concentration of both junior and senior Taekwondo students. This device is expected to facilitate the test and will record the result of the test. Every result of kick test will be recorded in a database which can be seen in a form of graphic. Aside of test, this device can also be utilized for practice equipment for the students. This device allows the students to practice kick and concentration without coach, but by using the system of this device. This research uses Research and Development method with ADDIE Model. The Analysis, Design, Development, Implementation, and Evaluation (ADDIE) Model is used as a framework to develop this device. The implementation of “Chagi Test” was done with 33 participants consist of 13 junior students 17 senior students and 3 coaches. The test was done on the feasibility and effectiveness of this device. The result of the design and development are hardware, namely E-mattress, E-Sandsack, kick indicator and software like NFF.chagitest. Hardware control system using micro-controller ATmega16 and serial communication using k-125r modules. The Nff.chagitest software is used as an interface created using visual basic 6.0 program where the test result indicated that this device is feasible to be used in kick test and kick practices. The Chagi test Testing consist of interface design, as well as device feasibility and effectiveness. The existing test result graphs can be used to view student progress and as a basis for training evaluation.

Keywords: Taekwondo, speed of kick, microcontroller, visual basic 6.0, ADDIE model

Introduction

The development of technology affects various aspects of human activities, one of which is sports. Almost every sport branches have been integrated with technology in every training sessions and competitions. Taekwondo is one of the martial arts which uses electronic match scoring systems and continues to grow. In the early 2000s, the Digital Scoring System was implemented to improve the competition with its ability to provide real time scoring to prevent misjudgement. Later in 2011, Taekwondo has used a new match system, namely Protection Scoring System (PSS). Scoring system with PSS was able to handle the issues of the previous system, which was more objective and avoid fraud of scoring system by using sensors planted inside the body protectors and special leg guard to activate the sensor. Based on the latest scoring system, Taekwondo athletes must learn to kick with a perfect movement where the back foot is on point.
Objectives
In accordance with the background identified above, the objective of this study are (1) Design a hardware which can be utilized for practice and kick test; (2) Design a user-friendly software to assist the existing hardware; and (3) Find out the feasibility and effectiveness of Chagi Test devices.

Research Questions
Based on the objectives explained above, the research questions are (1) How to design and create a device to determine the speed and accuracy of a kick? (2) How to design and create a device to test the concentration of Taekwondo Students? (3) How is the feasibility and effectiveness of Chagi Test device on its implementation?

Theory
The theory of learning which become the cornerstone of the Chagi Test device development is Behaviorism theory. In general, the conditioning (repetition) of a learning process will result in behaviour changes. Martial arts ability, especially Taekwondo, depends on the training process. According to Harsono in Alief Gandi (2013), training is a process of working repeatedly in a relatively long period of time which is then gradually enhanced based on individual abilities shown in the information of physiological and psychological functions to meet certain task. Wina Sanjaya (2013), states in the view of behaviouristic psychology, the study, in essence, is the formation of an association between the impression of senses with the tendency to act or relation between Stimulus and Response (S-R), which also called Stimulus-Response theory. This, Learning is an attempt to form stimulus and response relationships as much as possible. According to Suyono dan Haruyanto (2011), behaviourism experts’ views that learning is a changes of behaviour as a result of experience. Based on the behaviourism theory, to improve martial arts skills requires a repeated conditioning to create conditional response (reflex). Taekwondo focuses on the creation of reflexes in doing kicks, which serves in a match where students can respond to the opponent’s movement quickly as it has formed a reflex to kick back. In Ika Puspita W (2009) Joko Wilarso said that, on reflex movement, impulse has undergone a shortcut starting from excitatory receptor and forwarded by sensory nerve to the nerve center, accepted by connector nerve cells (association) without being processed inside the brain and directly forwarded to the motor nerves to be conveyed to the effector, ie muscle or glands, which was called reflex arc. Kick reflex affect the speed of kick performed by the students. To measure kick speed requires a device which is able to calculate and record kick speed response as a benchmark to improve the skills of the students. Such measurement is needed to motivate learners to further improve their martial arts skills especially kicks. While the benefit of such device for coaches is as a reference to evaluate the results of each student’s training.

Methodology
Chagi Test was developed using research and development method (R & D) with ADDIE model as a framework to developed the software and hardware. Analyze, Design, Develop, Implement, and Evaluate (ADDIE) describes a process applied to instructional design or a learning material in order to generate episodes of intentional learning (Branch, 2009). The ADDIE framework is a cyclical process that evolves over time and continues throughout the Chagi Test planning and implementation process (Figure 1). Other than that, in each process are evaluated.
CHAGI TEST DESIGN FOR TAEKWONDO STUDENT

Figure 1. The ADDIE framework (Peterson, 2003)

Literature Review

Taekwondo is a Korean cultural heritage known as the Korean martial art, which is in great demand throughout the world (Kim Joong Young, 2009). Suryadi (2003) stated that Taekwondo in Indonesia has grown in all provinces of Indonesia and was actively followed by more than 200,000 members, not including those not actively practicing. Taekwondo is a martial arts sport that has a competition event from regional, national until international level. Various techniques, tactics, etc. based on the basics of Taekwondo are referred to as ‘technical terminology.’ This includes all kinds of skills performed in Poomsae (patterns), Gyeorugi (sparring), Gyeokpa (breaking) and Hoshinsul (self-defense) (Kang Won Sik, 2012). Especially the competition category (kyorugi), in order to apply the tactics required skills and mastery of mastery skills technique, physical conditions, and mental (Arief W, 2008). Furthermore, Suryadi (2003) stated that to kick, one important component is the speed in order for the kick to be effective. Someone who has a quick kick then it will be easy about finding points in the competition. In addition, according to Pesurnay and Sidik (2007) the need for physical exercise in taekwondo, one of them is the speed of action-reaction. In this case, the speed of action-reaction is the length of time it takes to perform a kick (response) to the given stimulus. In addition, the need for physical exercise in taekwondo one of them is the speed of action-reaction. In this case, the speed of action-reaction is the length of time it takes to perform a kick (response) to the given stimulus.

Formerly, a referee used to assess the technical combinations performed by athletes in Taekwondo competitions and judge whether the technique was correctly and adequately performed, and award points of the athletes. This assessment method was observed to be biased and subjective (Partridg, et al, 2005). However, in 2004, World Taekwondo Federation decided that the athletes performances during the matches should be assessed using an electronic system (Moeing, 2015) for a more reliable assessment and the elimination of cheating (Chi, 2005). This system, in which the scoring system adopted along with electronic body protectors made an important contribution to the use of accurate techniques and skills (Tomello, et al, 2014). Sensor-fitted electronic body protectors enable more accurate and reliable scoring and provide coaches and athletes with the opportunity to develop their attack and counter-attack. Base of the new scoring system, training is required to accurately establish detectable kick sensors. Therefore, it is important to the coach to find ways to train the speed of kick and speed of the response, concentration and notes of how many inches or scores obtained.

Chagi Test

"Chagi" means to kick in Korean. Kick technique is very dominant in Taekwondo, it can even be said that Taekwondo is famous for its superiority in kicking technique (Mujib, 2009). Suryadi (2003) stated that the foot technique which can be used to attack
is Chagi (kick) using the underside of the ankle bone. The word "Test" comes from the Latin word "testum" which means a device for measuring the soil. In ancient France, the test means a measurement used to distinguish between gold and silver as well as other metals (Chabib, 2003). Anne Anastasi in mujib (2009), explained that tests are essentially objective and standard measures of behavioral samples. If combined, Chagi Test means a kick test. Kick test is a test to know one's ability to kick. Testing and Measurement are an integral part of human activity, as well as in sports teaching and training, because by implementing both, we may address the development and its drawbacks to make the right decision. Teaching and training in sports is a dynamic process, teachers or teaching coaches and coaches face issues that require resolution. The more thorough the information obtained (through tests and measurements) the better the decision is made.

Findings

Analysis and Design of Chagi Test

Based on the problems explained, it can be concluded that coach needs a device which can be used to train kick speed and accuracy, as well as concentration of Taekwondo students. Block Diagram is the first step in creating a Chagi Test for Taekwondo students. To design this system, the most important thing is to make the system into three main parts including the input, process and output (Figure 2).

![Block diagram of the chagi test device](image)

Development of Chagi Test

The design of Chagi Test for Taekwondo students is a device system to calculate the speed, accuracy and concentration of Taekwondo students. In addition, the device is designed to allow students to do concentration exercises as well as the speed and accuracy of their own kicks without the help of a coach. The inputs in the Chagi Test system consist of E-Sandsack, E-Matress, and NFF.chagitest software. E-Matress serves to know the distance of a kick and as a timer. E-Sandsack serves to detect incoming kicks and kick accuracy, as well as eliminating timers. The NFF.chagitest software will process the time takes in one kick and the kick accuracy. For more details about the design of chagi test device can be seen in Figure 3.
The development of Chagi test consists of the main buffer frame, E-Sandsack, E-Matress and kick target indicator. The main buffer is made of iron which is designed with sandsack head section can be shifted according to height with a range of 160 cm - 185 cm. 6 pieces of E-Sandsack consist of 3 pieces of the head parts and and 3 pieces of the body parts. E-Matress is designed to detect leg distance and kick start motion. The result of hardware development can be seen in Figure 4.

The electronic circuit consists of regulators, minimum Atmega16 systems, circuit connectors, matrix circuits and pulldown circuits. All electronic circuits are placed in a circuit box that can be seen in Figure 5.

Implementation of Chagi Test
The implementation of "Chagi test" was conducted to determine the feasibility of this device in facilitating the kick test process, to determine the speed and accuracy of kicks and concentration of Taekwondo students. As for the population of this study are 17 students of Jakarta State University as a member of "Taekwondo UNO UKO" and 7
students of SMP Negeri 7 Jakarta and 3 taekwondo coaches. The study was conducted for two months with the duration of exercise three times a week. The kick test is done three times in two months. Each kick test result is recorded in NFF.ChagiTest software. The purpose of recording is to see the increase in every athlete using the Chagi Test.

Evaluate of Chagi

NFF.chagitest software testing is done by connecting software with hardware using USB cable. The testing is done by pressing the concentration test button on the admin main form. Select the kick test mode to be automatic and the name of the athlete is tested and press the "OK" button, then "Start" button appears. To start the concentration test using random indicators, press the "Start" button and the kick target indicator will initiate and timer count. The target kick indicator will stop and stop counting the time when the athlete kicked E-sandsack. To use manual mode, select manual. For more details, see Figure 6.

Figure 6. Test Result of Concentration Test with software NFF.chagitest in Automatic and Manual mode

To connect hardware and software communications press the connection button so that the red connection indicator turns green. Select the type of kick, kick target and the name of the tested athlete then press "OK" button. When the athlete is on the mat, the foot will be displayed. When the athlete's feet are lifted then the stopwatch starts counting and stops counting when the kick activates the sensor in E-Sandsack. For more details, see figure 7.

Figure 7. The Test Result of Test Kick with NFF.chagitest software
To view the exercise chart using "Software NFF.chagitest" can be done by connecting vb 6.0 with Microsoft access 2010. The test is done by pressing the "OK" button after selecting the type of graph and the name of the athlete. If choosing the type of concentration test charts will be shown the concentration test results of the athlete. If you choose the type of test kick chart then you have to choose the type of kick you want to see the graph test results can be seen in Figure 8.

**Figure 8.** The test result of graphics test kicks software NFF.chagitest

In Table 1, shows the overall percentage of responses obtained from Taekwondo Athletes and Taekwondo Coaches (Sabeum) on: display design, usefulness, deviceability and NFF.chagitest software. Total respondents were 33 people consisting of 30 athletes and 3 coaches.

<table>
<thead>
<tr>
<th>Question Variables</th>
<th>Percentage</th>
<th>Average percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display design of software NFF.chagitest</td>
<td>84.4 %</td>
<td>81 %</td>
</tr>
<tr>
<td>Effectiveness of Chagi test and NFF.chagitest software</td>
<td>88%</td>
<td>81 %</td>
</tr>
<tr>
<td>Feasibility of Chagi test and NFF.chagitest software</td>
<td>88%</td>
<td>79 %</td>
</tr>
</tbody>
</table>

From the percentage of responses that have been obtained it can be concluded chagi test devices and software NFF.chagitest are effective and Feasible for applied exercise and test the athletes both junior athletes and senior athletes. These devices and software are very helpful to the coaches in conducting tests and knowing the development of each athlete.

**Discussion**

**Limitation**

The limitations of this device are on the buffer of sandsack. Because this device is in portable design so this device is light enough that it can be shifted in use by senior students. In addition, the reed switch sensor used on this device can be damaged if it gets a very hard kick.

**Recommendation**

Recommendations that can be given by the author as a consideration for further research, as follows:
1. Create a more robust frame design, by connecting parts using weld instead of nuts.
2. Use another magnetic sensor that is more resistant to damage

Conclusion
After performing the analysis, design, development, implementation and evaluation can be concluded as follows:

1. The system of the Chagi Test can measure the kick speed, accuracy and concentration of both junior and senior Taekwondo students, on the initial test, the gradual test and the final test that becomes easier by generating more valid data than the manual way.
2. Facilitate the practice and testing of the Taekwondo student concentration.
3. The effectiveness of Chagi Test device was 85 percent effective based on the result of coach and student assessment.

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References
