Development of power kick measuring devices for martial athletes

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Abstract. A martial artist needs a kick to make an attack on an opponent. In martial arts, the point of kicking is greater than the punch. There are various kinds of kicks such as front, back, side and swivel. Indeed, not all sports require kicks, one of the sports that require kicks is pencak silat, karate, taekwondo, muay-thai, and drajat fighting. The Indonesian government launched the National Sports Grand Design (DBON) training aids that can help in the training process of martial arts athletes included in this program. This study aims to determine the kick power of a martial artist to be more measurable when drilling training. This research uses a research approach and the development of tool prototypes. There are three important aspects that will be considered in this study, namely function, comfort and design. This research will examine the development of kick-measuring instruments in terms of prototype design. Furthermore, research related to reverse engineering will be developed to improve the quality of prototypes.

1 Introduction

Achievement sports are generally divided into several categories, ranging from game-type sports, measurable sports, and martial arts sports [1]. In these three sports categories, strength is one of the most needed biomotor components during training and matches, especially for the martial arts category. Martial arts are one of the sports that are competed at regional, national to Olympic levels [2]. Martial arts have also become one of the leading branches in Indonesia. This is evident from the government's attention to focus coaching on 3 martial arts sports out of a total of 14 general sports in the program carried out by the Ministry of Youth and Sports through the National Sports Grand Design (DBON) [3-4]. Some examples of types of martial arts in the world, especially in Indonesia, include Pencak silat, Taekwondo, Karate, Wushu, Judo, Boxing, Tarung degrees and many more [5].

As we know, martial arts is closely related to physical contact ranging from kicking, hitting to slamming [6]. A martial artist needs a good biomotor component to perform these movements. In addition to strength components, martial arts also require other biomotor components such as muscular endurance, cardiovascular, agility, flexibility, speed and power [7]. From some of the biomotor components above, strength is an important foundation for obtaining these abilities well. For example, biomotor power is obtained from a combination of strength and speed [8].
Martial arts are generally completed and divided into two categories, namely the category of beauty of motion (art) and the category of fighting (sparring) [9]. In the art category, strength is one of the keys in agile movement for one of the assessments in motion stability points. In the combat category, strength is the initial provision when kicking or punching can hit the target accurately, quickly and strongly [10]. This is not only able to get points but also avoid catch or blockage and can even knock down the opponent's horses.

To gain good strength, an athlete needs to perform training systematically, plan and apply training principles [11]. In addition, there is also a need for the support of appropriate infrastructure during the training process [12]. Speaking of facilities and infrastructure, currently, kick and punch training can only be counted the number of times an athlete does it in a unit of time. However, the strength itself will not be accurate if only calculated using visual observation. It needs a valid parameter to determine how much force is expended when hitting or kicking. While the parameters for measuring strength are also still few, moreover measuring strength specifically certain movements. This has an impact on the training process that is less measurable due to errors in selecting athletes [3].

Therefore, Sansak Digital (Sandit) is here as a solution to this problem. Sandit is an innovation made to the sansak tool, where the sansak tool itself is often used as a tool or training medium that is hung for kicks and punches. Through a modification by applying technological advances, Sandit is now here to help martial arts in measuring how much strength an athlete kicks, so it is hoped that it can help coaches in monitoring training results data to provide the right training program according to the needs of each athlete [6].

### 2 Method

In research using the research and development (R&D) approach method of tool prototypes. Researchers conducted interviews with martial arts club owners, coaches and athletes related to existing and unresolved problems in martial arts, one of which is digital sansak (Sandit). Therefore, researchers will try to make a prototype of digital sansak in martial arts athletes.

### 3 Results and Discussion

After conducting interviews with stakeholders such as club owners, coaches, and athletes. There are three important things that researchers focus on, namely function, comfort, and design. A prototype tool must function properly during trials to get feedback from stakeholders. Second is the comfort factor, an athlete when doing punches or kicks must be maximal so that the prototype must not cause pain when tried because it can cause a potential risk of injury. The third is design, there are four targets in the digital sansak prototype and each has code numbers 1-4 to make it easier to hit the target. In addition, there are lights that can help in giving instructions for kick directions.
According to the findings of the review of the relevant scientific literature, there are a significant number of works that are connected to the investigation of issues with judicial prejudice and participation in combat sports. On the other hand, practically every kind of martial art is plagued by the issue of judges and referees who lack enough training and consistently make mistakes in their decisions. According to A. Osipov, this is because the credentials of the judges aren't very high, there are not too many good training programs for the judiciary, and the regulations of the competition are often shifting around. All of these factors together contribute to the problem. There are instances when the modifications to the guidelines are so substantial that it is difficult not only for the competitors but also for the judges to adjust to them in a short period of time. In addition, there is research that is dedicated to the subject of matching the sporting equipment used for kick sports (helmets, gloves, and kappas) to the peculiarities of the current competitive bouts that are fought today. These studies may be found in the scientific literature.

According to the findings of a review of the relevant scientific literature, there are a significant number of works that are associated with the need for further investigation into the creation of protective equipment for boxers in order to shield them from perioral injuries. At the same time, it was discovered that the current forms of martial arts are very active and strenuous pursuits that call for a high degree of preparation, specialized abilities, and strategic planning on the part of the competitors in order to gain victory over their adversaries. Athletes may be provided with better quality training if their fighting skills are better understood. This is one of the chances that presents itself while organizing training for athletes. In addition, the studies of the physical, physiological, and psychological features of athletes who
specialize in kick sports are connected with age, gender, and level of training. These studies are required to improve the present information and establish the most effective training plans for players. It is important to note that the research and the authors of the article decided to bring attention to the possibility of purposeful development of the force of kicks being brought against the representatives of combat combatants and servicemen of the law enforcement agencies having clashes with the armed criminals. This is something that has been brought to the attention of the research community.

In order to accomplish this objective throughout the process of training athletes, it has been suggested that the techniques of intense functional training, also known as crossfit, be used. This particular kind of functional training has swiftly risen to the top of the popularity charts and is now considered to be one of the most well-liked forms of physical exercise among people in many nations across the globe. Exercises including running, gymnastics, weightlifting, and ballistic movements are some of the components that make up CrossFit, which is an acronym for "cross-functional training." In addition, it is essential that these workouts be performed vigorously in a predetermined sequence, with just a small amount of time set out for the body to recuperate in between each series.

This is one of the most crucial aspects of the process. Cross-training has been demonstrated to result in excellent rates of muscle development in those individuals who participate in it on a regular basis. These findings may serve as a foundation for the employment of cross-training methods in the process of focused development of the kick force of athletes performing martial sports. This development can be accomplished via the use of cross-training techniques. Additionally, the techniques of rigorous cardio-strength training that are employed today in the military and specialized colleges of the Russian Federation are utilized to increase the quality of physical training that is provided to officers and personnel who work for security agencies. It is widely held that the degree to which law enforcement officials are physically and mentally prepared to engage in conflict with criminals, particularly armed offenders, will determine whether or not they are effective in resolving the professional challenges they face. The efficiency with which police officers and other members of special units carry out their responsibilities will be the determining factor in determining their level of professional competence. CrossFit is a system of high-intensity, multipurpose workouts that, according to the views of certain experts, will assist in boosting the level of physical preparation of officers and personnel of the security services. CrossFit is also known as functional fitness.

4 Conclusion

The development of tools to measure kicks and punches in Indonesia is very helpful in martial arts. Sports such as taekwondo, pencak silat and karate which are included in the National Sports Grand Design (DBON) will be helped in the training process when using technology in coaching. Digital Sansak still needs to be developed in terms of material durability, where the number of punches or kicks that can be done until it runs out. The next research will focus on the durability of the product so that it can be used for a long time.

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References

2. A. Muladi, B. M. W. Kushartanti, Medikora 17 (2019)
4. S. Aryanti, Refleksi PON XX and Peparnas XVI Papua (2021)
5. H. A. Labibah, A. A. Lestari, UnTag Law Rev 6, 42 (2022)
8. N. Subekti, A. N. Warthadi, H. Mujahid, A. Abdullah, Smart Sport 18, 1 (2021)
10. Y. Simamora, A. Alnedral, Y. Kiram, R. Mardela, J. Haryanto, J. Gladitor 9 (2022)
13. M. G. ANA, S. Swidinata, F. Winata, N. Firmansyah, M. S. M. Suhadi, Musamus Journal of Physical Education and Sport (MJPES) 5, 02 (2023)