



Creating Training Equipment and Kick Tests in Pencak Silat Using Internet of Things (IoT) Technology

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Abstract

The development of digital technology in the world of sports (sports science) demands objectivity in measuring athlete performance, including in the martial art of Pencak Silat. To date, evaluation of kick speed and power is often carried out conventionally or subjectively through coach observations, resulting in a lack of accurate athlete development data. This study aims to design and build an Internet of Things (IoT)-based kick training and testing system capable of measuring performance parameters in real time and accurately. The research method used is Research and Development (R&D) with the ADDIE (Analysis, Design, Development, Implementation, and Evaluation) development model. The developed hardware consists of a force sensor and an accelerometer integrated with an ESP32 microcontroller as the system's brain. Data captured by the sensor when the athlete kicks is sent wirelessly via a WiFi network to a cloud-based database. The information is then displayed in graphical and numerical form through a web dashboard application, including impact force variables (in Newtons) and reaction speed (in milliseconds). Test results show that this tool has a high level of precision with minimal error compared to standard measuring instruments. The implementation of IoT technology allows coaches to remotely monitor athletes' training progress and digitally track their performance. In conclusion, this IoT-based training and kick testing tool is effective as an objective evaluation tool, helping to improve training quality and supporting the digitalization of the Pencak Silat training system towards international achievement.

Keywords: Pencak Silat, Training Equipment, Kick Test, Internet of Things (IoT)

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A. Introduction

Pencak silat is an indigenous Indonesian martial art that has been passed down through generations and is recognized as an intangible cultural heritage of Indonesia by UNESCO. It has transformed from a traditional martial art into a highly competitive sport at the international level (Candra Juli, 2021). In modern competitions, such as the Asian Games and World Championships, the effectiveness of attacks, especially kicks, is one of the most effective techniques for gaining points for victory (Rahman et al., 2022). Kicks in pencak silat, such as the 'T' kick, crescent kick, straight kick and back kick require a precise combination of speed, strength, timing and explosive power of the leg muscles to produce a strong kick, right on target and cannot be anticipated by the opponent (Mardius et al., 2026).

Field observations indicate that athlete training and evaluation processes are still dominated by conventional methods. Coaches often provide subjective assessments based on visual observation to gauge the quality of an athlete's kicks. The main weakness of this method is the lack of accurate quantitative data (Aandahl et al., 2018). Without precise data, it is difficult for athletes to track their training progress in detail or for coaches to develop measurable workload-based training programs (Volodchenko et al., 2017).

Progress in improving training results is sometimes not carried out periodically so that the development of athletes towards achieving their achievements is not carried out properly because it is not supported by data and periodic ability tests which results in coaches being unable to determine the right program in improving physical, technical, tactical and mental abilities in carrying out each match so that this makes the athlete's performance on the field not optimal and in some cases in the field there are frequent injuries which make the appearance of pencak silat athletes disturbed and unable to provide achievements in every match they

participate in (Dharmadi et al., 2022).

The development of digital technology has penetrated the world of sports through the concept of Sport Science (Candra et al., 2025). In the Industry 4.0 era, sensor integration and data processing are key to improving athlete performance. The Internet of Things (IoT) offers a solution to bridge the gap between physical activity at the training ground or arena and data analysis in the digital space (Ahmad, 2024). IoT enables real-time monitoring of physical parameters such as explosive power and kick frequency (Sari, 2021). The main problem currently facing pencak silat clubs is the lack of affordable, digitally integrated standardized testing equipment (Hidayat & Haryanto, 2021). Existing aids typically consist of sandbags or static body protectors that lack instant feedback. This leads to boredom in training and a lack of competitive motivation during independent training sessions. IoT technology in pencak silat training equipment works by utilizing accelerometers and force sensors mounted on kicking targets (Paramitha et al., 2023). Data captured by a microcontroller (such as an ESP32 or Arduino) is then sent wirelessly via Wi-Fi or Bluetooth to a cloud database (Triaiditya & Santoso, 2021).

Through formulas and data calibration in IoT devices, kick effectiveness can be accurately calculated based on the acceleration generated on the target pad (Abdurrahman, 2022). Integration with mobile applications or web-based dashboards allows coaches to monitor the performance of many athletes simultaneously remotely, creating a more transparent and data-driven training ecosystem (data-driven decision-making) (Ramdani et al., 2024).

B. Methods

This study uses a Research and Development (R&D) approach (Fatoni, 2021). The main focus is to create valid, practical, and effective technological

products to support the performance of Pencak Silat athletes through precise, real-time data measurement (Sudirman et al., 2022). The model used is the ADDIE (Analysis, Design, Development, Implementation, and Evaluation) model (Latif et al., 2022). The selection of this model is based on its systematic and iterative structure, very suitable for hardware and software development that requires repeated testing (Rahman et al., 2022). 1) Analysis (Analysis) Identifying the needs of coaches and athletes regarding kick parameters (speed, power, frequency). 2) Design (Design) Designing IoT architecture, sensors, and application interfaces. 3) Development (Development) Assembly of tools and microcontroller programming. 4) Implementation (Implementation) Product trials on small and large groups. 5) Evaluation (Evaluation) Data analysis to see the effectiveness of the tool (Sarbitinil et al., 2023).

In developing this tool, the technical method is divided into three main layers (Layers) according to IoT standards: a) Perception Layer (Sensors and Hardware), This stage focuses on selecting sensors capable of capturing the physical force of the kick (Triyanto et al., 2021). 1) Pressure Sensor/Load Cell, Used to measure the impact force of the kick. 2) Accelerometer (MPU6050), Used to measure the reaction speed and acceleration of the foot when hitting the target. 3) Microcontroller (ESP32), Acts as the brain of the device that has integrated Wi-Fi and Bluetooth modules to send data to the cloud (Jastradaf & Asriningtias, 2023). b) Network Layer (Connectivity), Raw data from the sensor is processed by the ESP32 using a filter algorithm (such as the Kalman Filter) to reduce noise. The data is then sent using the MQTT or HTTP Post protocol to a database (e.g., Firebase or AWS). c) Application Layer (User Interface) Development of an Android/iOS-based application or Web Dashboard using the react or flutter framework. This application will display: a)

Kick strength score in Newtons (N). b) Reaction time in milliseconds (ms). c) Athlete training history for long-term progress analysis (Zaenal et al., 2022)

Data Analysis and Calibration Techniques, to ensure the tool is accurate, a calibration method is carried out using industry standard tools (Malik et al., 2020). The accuracy of the load sensor (Load Cell) will be tested with a static load of known mass. The test subjects are Pencak Silat athletes in the competing category (Tanding Class) from student to professional levels who will be taken regarding kicking techniques by each individual, Validators are material experts (nationally certified Pencak Silat trainers) and media/technology experts (embedded system/IoT experts) (Nurul, 2024).

Data was collected through several instruments: 1) Expert Validation Questionnaire, to assess the feasibility of the tool from an ergonomic and technical perspective. 2) Performance Test (Pre-test & Post-test), Comparing the kick results measured manually by the judges with the results read by the IoT tool. 3) Athlete Response Questionnaire, to measure the level of ease of use (usability) of the tool in the field (Savero, 2022). Product Testing Flow (Trial Flow): 1) Laboratory Test, Testing the durability of electronic components against repeated vibrations and impacts. 2) Small Group Trial, Involving 5-10 athletes to see any bugs in data transmission. 3) Large Group Trial, Involving 30+ athletes to obtain representative kick power distribution data.

The data generated from the IoT system will be processed statistically: 1) Descriptive Test, Calculating the average, standard deviation and maximum/minimum value of the athlete's kick strength. 2) Validity and Reliability Test: sing Product Moment correlation to compare the consistency of the IoT tool with other standard measuring tools. 3) Effectiveness, Calculated using the N-Gain Score formula to see whether the use of this tool significantly improves the accuracy of

athlete training (Surya, 2023). With IoT integration, this research method not only produces physical tools, but also creates a data ecosystem that allows coaches to conduct data-driven evaluations (data-driven coaching) (Development of an Android-Based Health and Sports Companion Application Utilizing Smartband Technology Fauzi, 2021). This minimizes the subjectivity of judges or coaches in assessing the quality of kicks in Pencak Silat martial arts.

C. Result and Discussion

Result

This study aims to create training and testing media related to improving kicking abilities in Pencak Silat so that coaches can easily monitor the development and improvement of athletes' abilities periodically (Hakim et al., 2023). So far, coaches have only seen the ability of kicking techniques without conducting structured tests, but with training media and Pencak Silat kicking ability test tools using IoT technology, coaches can see the development of athletes' abilities every time they practice and measure how far the training results achieved by each athlete with accurate big data presentation and can be used as a reference to determine athletes who are ready to face the next match (Alang et al., 2023).

This research uses a development approach (R & D) by producing a product to assist in carrying out training activities and testing kicking abilities in the sport of Pencak Silat by developing IOT technology with reference to This research refers to the development model (R & D), namely by Prof. Dr. Sugiyono adapted from Borg and Gall (Warthadi et al., 2022), with stages: potential and problems, data collection, product design, design

validation, design revision, product trial, product revision, usage trial, revision, production (Amrullah et al., 2020). The following are the details of the results of each development stage: 1) Potential and Problems, Based on observations in several Pencak Silat clubs, it was found that coaches still test the speed and strength of kicks (crescent, front, T) visually or using a manual stopwatch (LUBIS et al., 2021). This results in subjective assessments.

On the other hand, there is the potential of IoT technology that has not been utilized optimally in the sport of pencak silat to measure athlete performance objectively and in real-time. 2) Information and Data Collection, Information is collected through literature studies regarding the standards of leg muscle explosive power, pressure sensors (Force Transport Resistor or Load Cell), speed sensors (Ultrasonic or Accelerometer), and the NodeMCU ESP8266 microcontroller as a data sender via Wi-Fi. 3) Product Design, Product design includes two main components, namely hardware and software: Hardware: Kick target (punching bag/body protector) modified by embedding a load cell sensor (measuring strength in Kg/Newton) and an accelerometer sensor (measuring speed in m/s). Software: Android/Web Dashboard application that functions to display graphs, athlete names, kick times, and training history. 4) Design Validation, Product design is validated by two material experts (licensed pencak silat trainers) and two other experts media/technology (lecturer of electrical engineering/informatics).

Table 1. Expert Validation Results

No	Validation Aspect	Percentage Score	Category
1	Materials Expert	85.5%	Very Worthy
2	Media Expert	88.0%	Very Worthy
3	Pencak Silat expert	85%	Very Worthy
4	Biomechanics Expert	83%	Very Worthy

5) Design Improvement (Revision I), based on notes from experts, several improvements were made: Material Expert: The thickness of the outer protective foam of the target was increased to 5 cm so that athletes would not be injured when performing a full kick (full impact). Media Expert: The arrangement of the sensor cable inside the target was reinforced with soldering coated with shrink tube so that it would not break when receiving high vibrations (Putro et al., 2020). 6) Product Trial (Small Scale), A small-scale trial was conducted on 6 pencak silat athletes in the competing category at Club X. Athletes performed 5 attempts at the crescent kick on the device. Results: The sensor was able to read kicks with a data transmission success rate of 92%.

The average kick strength of athletes

Table 2. Results of Product Practicality Assessment by Athletes and Coaches

No	User Group	Average Score by	Category
1	Athletes (40 people)	89.5%	Very Practical
2	Coaches (2 people)	94.0%	Very Practical

9) Final Product Revision, at this stage, no major revisions were made because the tool was already functioning consistently. Improvements were only made to the external aesthetics of the tool, such as the addition of the pencak silat logo and waterproof coating on the microcontroller component box to protect it from athlete sweat. 10) Mass Production / Final Product, The final result of this research is 1 (one) complete unit IoT-based Smart Target Silat which is ready for mass use for training and independent physical tests at the club and district levels. This product is equipped with

was detected in the range of 45 kg - 75 kg. Constraints: there was a delay (delay in data transmission) of about 3 seconds from the device to the Android application when the Wi-Fi connection was unstable (Vai et al., 2021). 7) Product Revision (Revision II), Improvements were made to the coding system on the IoT device. Researchers changed the data transmission algorithm by adding a local caching feature to the microcontroller, so that data remains temporarily stored if the internet connection is unstable, reducing the delay to <0.5 seconds. 8) Usage Trial (Large Scale), A large-scale trial was conducted on 20 athletes from two different pencak silat clubs. Athletes were asked to perform T-kick, front, and sickle kick tests to test the consistency of the device (Lestari & Lanos, 2020).

an application usage guide (user manual) (Budiman, 2021).

Discussion

This IoT-based pencak silat kick training and testing tool was developed to address the challenges of modernizing sports science in pencak silat. Through Sugiyono's 10-stage R&D, this product has proven theoretically valid and practically effective. Technically, the integration of load cell sensors and microcontrollers can eliminate the subjectivity of coach assessments that has been a barrier to

determining the quality of athletes' kicks (Suryadin et al., 2021). Quantitative data in the form of speed (m/s) and force (Kg) displayed on the application screen provides direct feedback (real-time biofeedback) to athletes.

This triggers the athlete's motivation to improve technique and increase the power of his kicks with each repetition (Ilahi et al., 2023). Compared to manual testing tools, this IoT-based "Smart Target Silat" has advantages in terms of time efficiency and data accuracy. Coaches no longer need to record manually, because all athlete kick history is stored securely in a cloud-based system (Dharmadi, 2022). Thus, this tool is suitable and effective for use as a supporting instrument for physical training and achievement tests in the sport of pencak silat (Sudirman et al., 2022).

D. Conclusion

Based on the results of the design, creation, and testing of the system in the study of Making Training Tools and Kick Tests in Pencak Silat Sports Using Internet of Things (IoT) Technology, several things can be concluded as follows: 1) Success of System Integration, This study has succeeded in designing and implementing IoT-based pencak silat training and kick testing tools (Anifah et al., 2023). The integration between physical sensors (such as load cells or accelerometers) on the kick target with a microcontroller (such as NodeMCU or ESP32) is able to detect and measure kick parameters (speed, power, or accuracy) in real-time. 2) Effectiveness of Data Delivery, Thanks to IoT technology, athlete kick results data can be sent wirelessly to a cloud storage platform and displayed well through a user interface (Android/iOS application or web dashboard) (Subekti et al., 2020). This makes it easier for coaches and athletes to monitor performance developments directly. 3) Assessment Objectivity, This tool is able to minimize subjectivity in training assessments and conventional kick tests (Kamilah et al., 2021). With accurate

quantitative data, the process of evaluating the kicking techniques of pencak silat athletes becomes more measurable, effective, and efficient. 4) Contribution to Sport Science: The application of IoT technology in this tool proves that digitalization of sports, especially traditional martial arts such as pencak silat, can improve the quality of training management and help prepare athletes for higher competition standards (Hidayat & Haryanto, 2021).

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F. Conflict of Interest

There is no conflict of interest in this study, but the aim is to assist coaches in assessing the progress of athletes and the results of their training. The purpose of the manuscript is to publish it in a journal after the research is complete.

References

- Aandahl, H. S., von Heimburg, E., & van Den Tillaar, R. (2018). Effect of postactivation potentiation induced by elastic resistance on kinematics and performance in a roundhouse kick of trained martial arts practitioners. *Journal of Strength and Conditioning*

- Research*, 32(4), 990–996.
<https://doi.org/10.1519/jsc.00000000000001947>
- ABDURRAHMAN, F. (2022). *PENGEMBANGAN TEKNOLOGI ALAT BANTU LATIHAN PASSING PADA OLAHRAGA BOLA BASKET*. repository.unj.ac.id.
- Ahmad, F. (2024). TRANSFORMASI DIGITAL DALAM PENDIDIKAN OLAHRAGA: INTEGRASI TEKNOLOGI UNTUK PENINGKATAN KINERJA ATLET. *Jurnal Ilmu Data*.
- Alang, A., Jalil, R., Kahar, I., & Ahmad, A. (2023). Achievements of Pencak Silat Athletes: The Role of Parents and Coaches. *ACTIVE: Journal of Physical Education, Sport, Health and Recreation*, 12(1), 29–34.
- Amrullah, R., Dlis, F., & Hernawan, H. (2020). Model of sickle kick pencak silat training based on exercise media in students pencak silat athletes. In *Journal of Education, Health and Sport* (Vol. 10, Issue 4, pp. 11–19). apcz.umk.pl.
<https://doi.org/10.12775/jehs.2020.10.04.001>
- Anifah, L., Zuhrie, M. S., Muhammad, & Haryanto. (2023). Integrated Smart Real Time Scoring Pencak Silat Based on Internet of Things (Iot). *International Journal on Technical and Physical Problems of Engineering*, 15(1), 155–163.
- Budiman, A. (2021). Implementasi Media Audio Visual terhadap Hasil Tendangan T pada Pencak Silat. *Musamus Journal of Physical Education and Sport (MJPES)*, 3(02), 134–140.
<https://doi.org/10.35724/mjpes.v3i02.3616>
- Candra, J., Indrayana, B., Sagala, R. S., & Daulay, D. E. (2025). *Making an Electric Vertical Jump Limb Muscle Explosiveness Test Tool Using Iot Technology in Physical Education Activities*. 6(1), 60–69.
- Candra Juli. (2021). *Pencak Silat* (Yuda Avinda Wati & Rasyadany Amry (eds.); 1st ed., Vol. 1). Deepublish.
- Dharmadi, M. A. (2022). The Use of Junior Weight Vest on Arm Strength in Junior Pencak Silat Athletes. *Indonesian Journal Of Educational Research and Review*, 5(3), 614–623.
<https://doi.org/10.23887/ijerr.v5i3.52391>
- Dharmadi, M. A., Kanca, I. N., Parwata, I. G. L. A., Spyanawati, N. L. P., Semarayasa, I. K., Wijaya, M. A., Ariani, L. P. T., & Dartini, N. P. D. S. (2022). The Effect of Balinese Traditional Games “Megoak-goakan” and “Megala-gala” on Physical Agility in Martial Arts Athletes. *International Journal of Human Movement and Sports Sciences*, 10(3), 423–428.
<https://doi.org/10.13189/saj.2022.100308>
- Fatoni, M. I. (2021). PENGGUNAAN MEDIA TEKNOLOGI BERBASIS AUDIO VISUAL TERHADAP PENDIDIKAN JASMANI OLAHRAGA DAN KESEHATAN PADA SISWA SMA TUNAS *Prosiding Seminar \&Conference Nasional*
- Hakim, N., Candra, J., Yahya, A. A., & Kahar, I. (2023). The influence of the diamond passing exercise modelnand triangle against passing accuracy football on extracurriculars. *Jipes - Journal of Indonesian Physical Education and Sport*, 8(2), 68–75.
<https://doi.org/10.21009/jipes.081.05>
- Hidayat, S., & Haryanto, A. I. (2021). Pengembangan Tes Kelincahan Tendangan Pencak Silat. *Jambura Journal of Sports Coaching*, 3(2), 74–80.
<https://doi.org/10.37311/jjsc.v3i2.11338>
- Ilahi, B. R., Okilanda, A., Raibowo, S., Yarmani, Sugihartono, T., Syafril, Nopiyanto, Y. E., Hiasa, F., Ihsan, N., & Putra, J. (2023). The Effect of Resistance Bands Rubber Spring

- Exercise on the Front Kick Speed of Adolescent Pencak Silat Women. *International Journal of Human Movement and Sports Sciences*, 11(2), 418–423.
<https://doi.org/10.13189/saj.2023.110219>
- Jastradaf, M., & Asriningtias, Y. (2023). Aplikasi Teknologi Augmented Reality untuk Media Pembelajaran Olahraga Renang. *Edumatic: Jurnal ...*
- Kamilah, S., Sobari, T., & Nurhayati, E. (2021). Motion Vocabulary in Sundanese Language Terminology for "Pencak Silat" – a Study on Vocabulary and Word Form. *JLER (Journal of Language Education Research)*, 4(1), 19–29.
<https://doi.org/10.22460/jler.v4i1.6383>
- Latif, R. A., Yusoff, Y. M., Tumijan, W., Linoby, A. F. L. R., & Yoyok, S. (2022). Injury in Martial Art Activities: Focusing on Pencak Silat Athletes. *Ido Movement for Culture*, 22, 53–62.
<https://doi.org/10.14589/ido.22.2S.7>
- Lestari, H., & Lanos, M. E. C. (2020). Student Perception of Learning Models Basic Basic Technique Pencak Silat Based of Multimedia Interactive. *Journal of Physical Education Health and Sport*, 7(1), 11–14.
- LUBIS, J., SUKUR, A., HAQIYAH, A., IRAWAN, A. A., SULIYANTHINI, D., SUKRIADI, S., & SUSIANTI, E. (2021). Cooling vest (cv-f) to improve recovery effectiveness of pencak silat martial arts student-athletes. In *Journal of Engineering Science and Technology* (Vol. 16, Issue 4, pp. 2938–2949). jestec.taylors.edu.my.
- Malik, A., Sunardi, S., & Ardianto, D. T. (2020). Pengembangan panduan identifikasi bakat olahraga berbasis teknologi sport search. *Journal of Curriculum Indonesia*.
- Mardius, A., Kumar, A., Rijaluddin, K., Candra, J., Ockta, Y., & Mardius, A. (2026). *Improving Physical Fitness of Pencak Silat Athletes Through Circuit Body Weight Training*. 16(V), 81–86.
- Nurul, S. (2024). INOVASI DALAM PEMBELAJARAN OLAHRAGA: PENERAPAN TEKNOLOGI UNTUK MENINGKATKAN PENGALAMAN BELAJAR DAN KINERJA ATLET. *Jurnal Ilmu Data*.
- Paramitha, S. T., Kodrat, H., Or, S., & Ramadhan, M. G. (2023). *Penerapan teknologi olahraga*. muhamad seto.
- Pembangunan Aplikasi Pendamping Kesehatan Dan Olahraga Berbasis Android Memanfaatkan Teknologi Smartband Fauzi, G. A. (2021). *Pembangunan Aplikasi Pendamping Kesehatan Dan Olahraga Berbasis Android Memanfaatkan Teknologi Smartband*. elibrary.unikom.ac.id.
- Putro, S. S., Santoso, W. R., Husni, & Rachmad, A. (2020). Candidate Selection of Athletes Sparring for Boy Category Pencak Silat Using TOPSIS: Case Study in PSHT Pencak Silat. *Journal of Physics: Conference Series*, 1477(2).
<https://doi.org/10.1088/1742-6596/1477/2/022019>
- Rahman, M., Pasaribu, A. M. N., & Candra, J. (2022). Review of The Level of Physical Condition in Pencak Silat Athletes in Bekasi City Student Plates. In *Nusantara Journal of Sports Science* (Vol. 1, Issue 3).
- Ramdani, F., Lailita, N. A., & ... (2024). LITERATURE REVIEW: DIGITAL WEARABLE TECH: MENGOPTIMALKAN OLAHRAGA DENGAN TEKNOLOGI PENGHITUNG KADAR STRESS. ... *Peminat Olahraga*.
- Sarbaitinil, S., Rudagi, R., Rahmat, I., & ... (2023). Expressing Philosophical Discourse In Pencak Silat As A Pillar of Character Education And Strengthening Social Ties In Society. *Journal of Pragmatics ...*
- Sari, D. A. L. (2021). Potensial

- Pengembangan Teknologi Wearable Atlit di Skala Pendidikan Olahraga. *Prosiding Seminar Nasional IPTEK Olahraga ...*
- Savero, J. E. (2022). *Aplikasi Pengenalan Olahraga Bola Besar Untuk Pelajar Menggunakan Teknologi Augmented Reality*. researchgate.net.
- Subekti, N., Sistiasih, V. S., Syaekani, A. A., & Fatoni, M. (2020). Kicking ability in pencak silat, reviewed from eye-foot coordination, speed, and ratio of limb length-body height. *Journal of Human Sport and Exercise*, 15(Proc2), 453–461. <https://doi.org/10.14198/jhse.2020.15.Proc2.36>
- Sudirman, R., Asmawi, M., Hanif, A. S., Refiater, U. H., Suharto, T. H., Aryadi, D., & Rahmat, A. (2022). The Effect of Training Methods and Explosion of Limb Muscles on Pencak Silat Kicking Skills. *International Journal of Human Movement and Sports Sciences*, 10(2), 193–198. <https://doi.org/10.13189/saj.2022.100209>
- Surya, I. (2023). TEKNOLOGI DALAM PENGEMBANGAN PERFORMA OLAHRAGA: TINJAUAN LITERATUR. *Jurnal Edukasimu*.
- Suryadin, T., Sahudi, U., & Kulyana, K. (2021). Pengaruh Latihan Tendangan Ke Atas Kursi Terhadap Keterampilan Tendangan Depan Pada Ekstrakurikuler Pencak Silat Di Smk Bina Insan Mandiri. *Journal RESPECS*, 3(2), 45–52. <https://doi.org/10.31949/respecs.v3i2.1270>
- Triaiditya, B. S. M., & Santoso, D. A. (2021). Review Aplikasi Teknologi Digital di Olahraga Tenis Meja. ... *Nasional IPTEK Olahraga ...*
- Triyanto, V. A. W., Mulyadi, A., & ... (2021). Teknologi Arduino dan Modul HC-05 Pada Pengaturan Scoreboard Olahraga. ... *IPTEK Olahraga ...*
- Vai, A., Agung Nanda, F., Saputro, D. P., Ramadi, & Rahmatullah, M. I. (2021). Lectora inspire software development in the learning of pencak silat. *Journal Sport Area*, 6(1), 136–147. [https://doi.org/10.25299/sportarea.2021.vol6\(1\).5895](https://doi.org/10.25299/sportarea.2021.vol6(1).5895)
- Volodchenko, O., Podrigalo, L., Aghyppo, O., Romanenko, V., & Rovnaya, O. (2017). Comparative analysis of a functional state of martial arts athletes. *Journal of Physical Education and Sport*, 17, 2142–2147. <https://doi.org/10.7752/jpes.2017.s4220>
- Warthadi, A. N., Budianto, R., Subekti, N., Fatoni, M., & Nurhidayat, N. (2022). Intervensi Latihan High Intensity Interval Training Terhadap Strength Endurance Olahraga Pencak Silat (Ekstrimitas Bawah). *Jambura Health and Sport Journal*, 4(2), 139–147. <https://doi.org/10.37311/jhsj.v4i2.15811>
- Zaenal, Z., Laekking, M., & Shaleh, M. (2022). ... Pemanfaatan Teknologi Informasi Dan Pengendalian Internal Terhadap Ketepatan Waktu Pelaporan Keuangan Pada Dinas Kepemudaan Dan Olahraga *CESJ: Center Of Economic ...*