

## Smart Reaction Trainer: Development of Technology-Based Reaction Training Tools for Futsal Players

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**Abstract:** This study aims to create a technology-based reaction training aid. This tool is called the Smart Reaction Trainer. The research was conducted in Jakarta, while the manufacturing process and trial data collection were carried out at Campus B of the Faculty of Sports and Health Sciences, State University of Jakarta. The method used in this research was the Research and Development method using the ADDIE model development approach (analysis, design, development, implementation, evaluation). The research subjects were futsal players from the State University of Jakarta. The result of the study was the successful creation of a reaction training tool named Smart Reaction Trainer with two reaction time modes, namely 1.5s and 0.7s. The results of the tool trial assessment by futsal players showed that it was highly feasible at 100%, and in terms of attractiveness, 90% rated it very interesting and 10% rated it interesting. The conclusion is that the Smart Reaction Trainer can be used as an alternative training medium that is effective, innovative, and suitable for the needs of modern futsal, and the involvement of technology-based assistive devices greatly helps futsal players in developing their reaction abilities.

**Keywords:** Smart Reaction Trainer, Futsal, Technology

*Received: 10 May 2026; Revised: 19 May 2026; Accepted: 28 May 2026*

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Cite: Fitranto, N., Wardoyo, H., Hasibuan, M. H., Ihsani, S. I., & Andri, G. (2026). *Smart Reaction Trainer: Development of Technology-Based Reaction Training Tools for Futsal Players*. *Journal Segar*, 14(2), 57-64.

<https://doi.org/10.21009/segar/1402.02>



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## INTRODUCTION

Futsal has developed rapidly in schools, communities, and professional clubs (Manescu, 2016). Futsal is not only a recreational game but also a means of achieving accomplishments from an early age to the professional level. Futsal is a type of high-intensity sport that simultaneously demands strong physical, motor, and cognitive abilities (Yustika, 2019). Futsal athletes must be able to perform repeated high-intensity exercises with short recovery times because the game is played on a small court and at high speed (Naser, 2017). In futsal, there are four positions, namely fixo/anchor, ala/flank, pivot, and goalkeeper (Nascimento, 2021). All of these positions are very important in futsal games. Futsal athletes are required to have optimal physical condition support to maintain performance throughout the match (Nascimento. Henrique, 2021).

Futsal currently demands reaction speed and the ability to adjust movements to changing stimuli, such as the movement of the ball, teammates, and opponents (Corrêa U. C., 2012). In complex game situations, players must process various visual and auditory stimuli, such as the position of the ball, opponents' movements, and tactical

instructions from the coach (Corrêa U. C., 2020). A person's ability to respond to stimuli as quickly as possible is known as reaction speed (M. Knoop, 2013). In almost all futsal match situations, athletes must quickly adapt to changing game conditions. Futsal players must respond quickly in fast passing situations to anticipate the direction of opponents' passes, change body position, and initiate foot or body movements to intercept the ball. Players must also respond quickly to opportunities when shooting, especially in the narrow area of a futsal court (Corrêa U. C., 2020).

One of the important physical abilities in futsal is the component of reaction speed, also known as response time, because it helps players respond to unexpected stimuli such as the direction of the ball, opponent movements, and decision-making in a short amount of time (Restu, 2023). Good reaction ability is directly correlated with how well players perform individually and as a team on the field. Speed in futsal is highly needed, whether it is reaction speed, movement speed, or sprint speed, because in futsal games athletes are often faced with situations where they must act quickly to make decisions (Permatasari, 2016).

Speed is classified into two types, namely movement speed and reaction speed. Reaction speed is the ability of an individual to respond to stimuli or stimulation through optical (eyes), tactile (skin), and acoustic (ears) senses (Restu, 2023). Therefore, athletes respond more quickly to stimuli if they have very good response times. There are two types of reactions: individual and complex reactions. If a person responds to a stimulus as quickly as possible in a previously known way, then it is called a single response, and if a person responds to a stimulus as quickly as possible in a previously unknown way, then it is called a complex response. Hand reaction speed is one of the reaction speeds needed in futsal. This is because the hands act as executors in responding to incoming stimuli (Rohman, 2020). In several sports, for example in structured reactions, hand and foot reaction speed are very important for blocking or resisting attacks.

Reaction speed training is usually still carried out using conventional methods in futsal training, especially in amateur futsal academy clubs and school futsal extracurricular activities. Training using tennis balls, coach commands, and various manual drills created based on the coach's intuition are some of the most common training methods (Rohman, 2020). These methods have long been part of futsal training programs, and they are relatively easy to implement and do not require special equipment. Most coaches have not yet used technology-based training tools capable of providing kinesthetic, auditory, and visual stimuli. Limited costs, as well as coaches' lack of knowledge about technology and training tools, are some of the reasons why the use of technology remains very low. This condition indicates a gap between the demands of modern futsal and training practices in the field, emphasizing the importance of developing technology-based reaction training tools that are practical, affordable, and easy to use.

In recent decades, advances in digital technology have transformed sport science into a discipline that no longer relies on conventional approaches based on experience and subjective observation, but has evolved into a discipline that depends on data, scientific evidence, and applied technology (Widiastuti, 2024). Athletes in competitive sports are required to achieve their best level of performance with a very small margin of error. In situations like this, conventional methods often cannot provide consistent, accurate, and objective information about the physical, motor, and cognitive conditions of athletes. Because of these limitations, technology is used as a scientific tool to more

accurately measure, analyze, and evaluate athlete performance. Sport science can collect quantitative data to support decision-making in the training process.

The increasing complexity of athlete performance demands has also encouraged the use of technology in sport science (Hulfian, 2021). Athletes are not only required to be physically strong, but they must also excel in motor coordination, reaction speed, decision-making, and high mental readiness. To meet the demands of sports that are becoming increasingly competitive, fast, and complex, the use of technology in sport science has become very important. With technologies such as wearable devices, biomechanical sensors, motion analysis systems, and visual reaction devices, various components can be measured simultaneously and in real time. The use of technology allows athletes to feel more enthusiastic and motivates them to train. In addition, the use of technology makes the training process feel easier and more comfortable (Hulfian, 2021).

Based on the description above, it can be concluded that the use of technology in sport science is a logical consequence of the fundamental needs of sports that emphasize sustainability, objectivity, accuracy, and efficiency in athlete performance. Technology-based reaction training tools such as the Smart Reaction Trainer are designed to meet the needs of modern futsal training today. High-tech reaction time measurement devices are quite expensive, but that does not mean we should ignore technological advancements and the capabilities of current tools. Researchers strive to create tools that are cheaper, more accurate, safer, and portable, which can be used by everyone. Therefore, to ensure that the world of sports continues to progress, advanced tools are needed that can stimulate or provide stimuli to improve abilities or technical skills in playing futsal.

## **METHODS**

This study focuses on developing a reaction training aid product for futsal players; therefore, the approach and method used in this study is the Research and Development (R&D) method using the ADDIE model (Rusmayana, 2021), which is one of the models used in developing training models by paying attention to the basic stages of simple training design, consisting of five phases: (a) Analysis, (b) Design, (c) Development, (d) Implementation, and (e) Evaluation.

1. **Analysis.** Preliminary research is needed to analyze the needs found in the field. This is carried out so that the researcher obtains the information needed to develop a reaction aid for futsal players.
2. **Product Design.** Based on the potential problems and data collection related to existing training aids in futsal, the researcher will design the product to be relevant to match situations.
3. **Development.** After designing the reaction training aid for futsal, the researcher discusses and consults it with experts or specialists, namely lecturers and futsal coaches.
4. **Implementation/execution.** After the tool has been completed, the researcher plans to conduct trials with futsal athletes using various modes or reaction times.
5. **Evaluation.** After the development of the reaction tool has been carried out, the tool for futsal is evaluated. The evaluation stage can be conducted throughout the four stages above, and the researcher will continue making improvements to perfect the existing tool.

## RESULT

Based on the results produced by the research team, a media tool was created to assist athletes in conducting training, namely: a reaction training aid called Smart Reaction Trainer, which is a training aid that uses the Arduino Uno application with a working system utilizing lights as stimuli and touch reactions to obtain reaction scores or data. This tool consists of two time modes, namely 1.5-second mode or 0.7-second mode, which can be adjusted according to training needs. At this stage, the researchers developed the initial product design form.

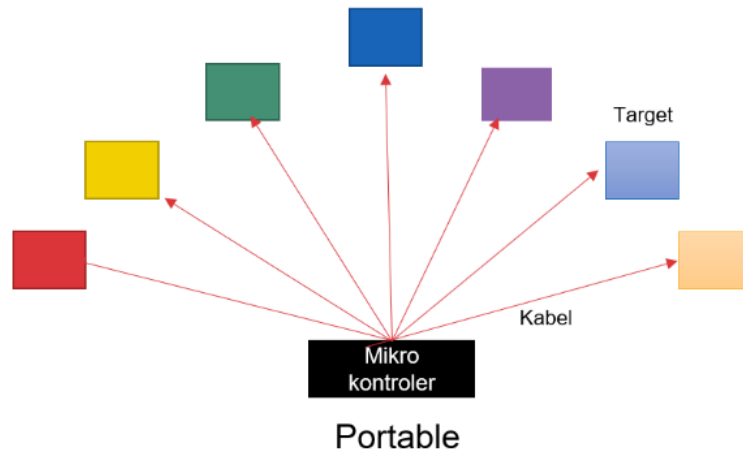


Figure1. Initial Product Design Image Based on a Microcontroller

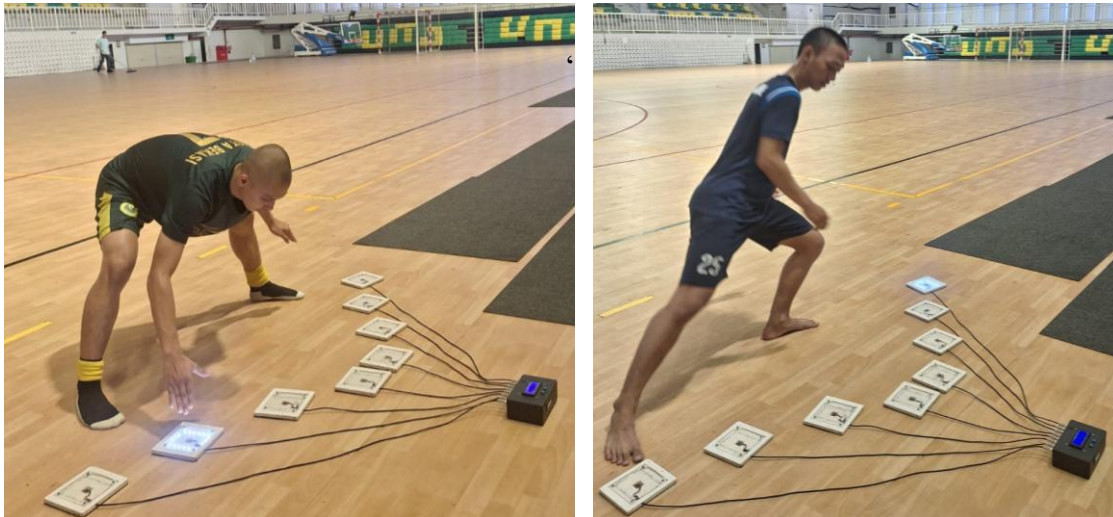


Figure 2. Smart Reaction Trainer Product Result Image



Figure 3. Display of Smart Reaction Trainer Results

Table 1. Assessment Results of the Tool Usage Trial

No	Aspect	Assesment			Persentase		
1	Feasibility Aspect	Feasible	Fairly Feasible	Not Feasible	100%	0%	0%
2	Attractiveness Aspect	Very Attractive	Attractive	Not Attractive	90%	10%	0%

Based on the trial results with futsal players, the results were obtained from 2 aspects, namely the feasibility aspect, which obtained a result of 100% feasible, and the attractiveness aspect of the tool, which obtained results of 90% very attractive and 10% attractive.

## DISCUSSION

The research and development of the futsal reaction training aid created was the result of potentials and problems identified by the researcher by observing someone conducting goalkeeper training as well as players who could better stimulate athlete stimuli. The purpose of this study was to create a reaction training aid aimed at helping improve the quality of players' reactions. The principle of ecological dynamics in sport science emphasizes the importance of interaction between perception, environment, and athlete actions during training and competition (Thiago Augusto Costa de Oliveira, 2023)

The use of the Smart Reaction Trainer has several advantages. First, this tool has the ability to provide more consistent and unbiased stimuli compared to instructions given manually by coaches. To meet training needs, the intensity of the stimuli can be adjusted. For example, the 1.5-second mode is used for the adaptation stage and the 0.7-second mode is used for high-intensity training. Second, with this tool, real-time performance measurement can be carried out by displaying the average reaction time. Third, athletes tend to be more enthusiastic when training using interactive digital media rather than conventional repetitive methods. Fourth, this tool helps individuals perform varied exercises. According to the athlete's age, performance level, and needs, coaches can adjust the difficulty level of the stimuli.

This Smart Trainer Reaction training aid also has weaknesses obtained from validation results and trials on futsal athletes, including the need for the LED strip lights to be made brighter or replaced with colored lights. There is also a need for a display board for scores and timers, cables that need to be extended according to foot distance, and a reaction board that is made sturdier.

In long-term athlete development, knowing when to apply the right training stimulus is very important for effective programming and improving athletic performance (Burhaein, 2024). The lack of overall improvement in reaction performance may indicate that the training is not effective for all components of perceptual-motor performance (McNeil, 2021). Repeated reaction training can improve neuromuscular coordination and nerve impulse transmission. Athletes can perform faster and more accurate movements in match situations thanks to these adaptations. According to research on futsal goalkeeper reaction behavior, response time is very important for successfully dealing with opponents' shots (Renaldi, 2023).

The use of the Smart Trainer Reaction still needs to be combined with technical, tactical, and real-game training so that athlete performance adaptation occurs comprehensively. With the development of the right training program, this tool has the potential to become one of the instruments or supporting tools in modern futsal achievement development. Further research is also needed to examine the effectiveness of using technology-based reaction tools.

## CONCLUSION

Futsal games take place at a fast pace, are dynamic, and full of stimuli that must be responded to in a short amount of time. This ability greatly determines the effectiveness of decision-making and player performance on the field. Developments in sports science and technology offer solutions through the use of this Smart Reaction Trainer tool, which is capable of providing visual and kinesthetic stimuli in a more measurable, objective, and real-time manner.

## REFERENCES

- Burhaein, E. &. (2024). The influence of imagery and agility training on futsal goalkeeper reaction time. . *International Journal of Disabilities Sports and Health Sciences*, 7(1), 21–33. .
- Corrêa, U. C. (2012). The Game of Futsal as an Adaptive Process. *Nonlinear Dynamics, Psychology, and Life Sciences*, , Vol. 16, No. 2, pp. 185-204.
- Corrêa, U. C. (2020). Higher Variability in Dyadic Interaction Plays a Positive Role in the Decision Making of Futsal Passing. . *Kinesiology*, 52(2), 290–298. <https://doi.org/10.26582/k.52.2.17>.
- Hulfian, S. a. (2021). Aplikasi Teknologi Footwork Training Untuk Peningkatan Agility Pemain Futsal Smas Al Hasaniyah Nw Jenggik. *Gelora: Jurnal Pendidikan*

- Olahraga dan Kesehatan IKIP Mataram*, 6(2), 6(2), 119–125.  
<https://doi.org/10.33394/gjpok.v6i2.4040>.
- M. Knoop, J. F.-F. (2013). Evaluation of a specific reaction and action speed test for the soccer goalkeeper. 27(8).
- Manescu, C. (2016). *Why Everybody Loves and Plays Futsal*. United Kingdom: Marathon, 8(2), 200-205.
- McNeil, D. G. (2021). Imagery training for reactive agility: Performance improvements for decision time but not overall reactive agility. . *International Journal of Sport and Exercise Psychology*,, 19(3), 429–445.
- Mendes, D. (2022). Talent Identification and Development in Male Futsal: A Systematic Review. *In International Journal of Environmental Research and Public Health*, 19(17), <https://doi.org/10.3390/ijerph191710648>.
- Nascimento, H. (2021). Vision in futsal players: Coordination and reaction time. . *International Journal of Environmental Research and Public Health*, 18(17) <https://doi.org/10.3390/ijerph18179069> .
- Nascimento. Henrique, C. A.-P.-P.-T. (2021). Vision in Futsal Players: Coordination and Reaction Time. 18(17).
- Naser, N. A. (2017). Physical and physiological demands of futsal. *In Journal of Exercise Science and Fitness* , (Vol. 15, Issue 2, pp. 76–80). <https://doi.org/10.1016/j.jesf.2017.09.001>.
- Permatasari, N. K. (2016). *Pengembangan alat pengukur waktu reaksi tangan berbasis microcontroller*. Bandung: Jurnal Terapan Ilmu Keolahragaan.
- Renaldi, M. e. (2023). The effect of reaction ball training on futsal goalkeeper reaction. *Journal of Physical Education Health and Sport*. .
- Restu, A. P. (2023). Perbedaan Waktu Reaksi Bunyi Dengan Waktu Reaksi Mata. *Journal of Sport (Sport, Physical Education, Organization, Recreation, Training)*, 7(3), vol. 7, no. 3, pp. 681–692, Doi: 10.37058/sport.v7i3.8822.
- Rohman, A. F. (2020). Pengaruh Latihan Menggunakan Bola Tenis Terhadap Kecepatan Reaksi Dan Konsentrasi Kiper Futsal UNESA. *JSES : Journal of Sport and Exercise Science*,, 11(2), Vol 3, No 2, (56-60).
- Rusmayana, T. (2021). *Model Pembelajaran Addie (R. Hartono, Ed.; 1st ed.)*. Bandung: Widina Bhakti Persada.
- Thiago Augusto Costa de Oliveira, K. D. (2023). Interpersonal coordination tendencies and perception of visual information for decision-making in futsal. *Journal of Psychology of Sport and Exercise*, Vol 66, <https://doi.org/10.1016/j.psychsport.2023.102403>.

- Widiastuti, M. S. (2024). Development of the Ultrasonic Sensor Based Modification Coordination Test Device. *Retos*, 598-606.
- Yustika, G. P. (2019). Futsal's Inside Human Sport Physiology : A Literatures Description. *6*(2).