

# Application of alacrity as a means to improve athlete's agility

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**Abstract.** Agility and speed are two important factors that determine the performance of athletes in various sports. Currently, agility and speed measurements still rely on the use of a stopwatch and human response speed. Although this method has been used in various sports settings for many years. There are several underlying problems, including low levels of accuracy and consistency, the potential for trainer or assessor fatigue, time-consuming data processing, and the need for proper agility measurement tools. By considering the problems from this background, this study aims to present the development of a touchless sensor-based agility and speed measurement tool that can help improve accuracy, consistency, and efficiency in measuring athlete agility and speed, namely "The Alacrity". With this tool, athletes are expected to be able to plan appropriate training programs to improve their performance and process data manually because the results are presented in a special Windows application and can be viewed in real-time.

## 1 Introduction

Agility and speed are two important factors that determine the performance of athletes in various sports. The faster the athlete performs, the better the results, in this case, timeliness is very important in determining the success of tests and competitions [1]. Accurate and consistent measurement of these two factors is essential for evaluating athlete progress, designing effective training programs, and improving competition results.

### 1.1 Background of the problem

Currently, agility and speed measurements still rely on the use of a stopwatch and human response speed. Although this method has been used in various sports settings for many years. Some of the underlying problems, among others, are as follows: (1) Low level of accuracy and consistency, the use of a stopwatch and human response speed as a tool for

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measuring agility and speed has a low level of accuracy and inconsistent results. Factors such as delays in human reactions and human errors in timing can lead to inaccurate results. This can make it difficult for coaches or researchers to carry out proper monitoring and analysis of athlete progress. (2) Potential trainer or assessor fatigue, when testing many people or participants, trainers or assessors often have to perform tasks that require high focus and concentration. Manual use of a stopwatch and data analysis requires precision and patience, which can cause the trainer or assessor to experience mental fatigue and impact measurement accuracy. (3) Time-consuming data processing, the data generated from the stopwatch needs to be processed again in order to provide meaningful measurement results. Processing this data can be time-consuming and effort-consuming, especially when scoring is done on a large number of athletes. (4) The need for proper agility measurement tools, for both professional and amateur athletes, a proper understanding of their agility and speed lays the foundation for designing an effective training program. Therefore, there is an urgent need to develop measurement tools that can provide accurate and consistent data regarding the agility and speed of athletes.

By considering the problems from this background, this study aims to present the development of a touchless sensor-based agility and speed measurement tool that can help improve accuracy, consistency, and efficiency in measuring athlete agility and speed, namely "The Alacrity". With this tool, athletes are expected to be able to plan appropriate training programs to improve their performance and process data manually because the results are presented in a special Windows application and can be viewed in real-time.

## **1.2 Previous research**

The relevant research is the development of an android-based physical fitness test measurement application [2] with a tool effectiveness level of 87%, sports measurement test experts 89%, and practitioners 92% so that it is declared good and becomes a new development. [3] also developed an agility measurement test tool using an infrared sensor with product effectiveness having results of 85% material experts, 96% media experts, and 85% by practitioners so that an agility measuring tool is effective to use.

Development of an agility test measuring instrument based on infrared sensor technology by Ramadhan et.al [4] as an update to an agility test measuring instrument with a stopwatch with validation results by experts an average of 98%. The next research is the application of a fitness test for cardiovascular endurance in the application in the form of a new product for measuring heart and lung endurance levels. This product contains general fitness information using the VO<sub>2</sub>max test method, the process of calculating values by classification, and research results with feasibility values. of 88.41% [5]. Aji [6] also developed a ladder tool for coordination, agility, and power exercises obtained from the validation results from material experts of 86% or feasible; media expert by 80% or appropriate; small group trials of 84.42% or appropriate; large group trials of 82.12% or appropriate. Based on the findings from Baskoro et.al [7] the initial feasibility test of a motion sensor-based side step agility assessment tool in Stage I, the sample achieved an assessment score of 90.93%. Expert trainers assessed it at 90.40%, IT media experts provided an assessment of 88.80%, and test and measurement experts rated it at 91.20%. Moving on to the Stage II feasibility test of the same tool, the sample's

assessment score improved to 93.20%, expert trainers rated it at 92.00%, IT media experts at 91.20%, and test and measurement experts at 94.40%. The research data collected led the researchers to the conclusion that the development of this motion sensor-based side-step agility assessment tool is highly viable for measuring athletes' agility levels.

In the study conducted by Putra [8], the impact of ladder drills and zig-zag run exercises on improving agility in futsal athletes was investigated. The research findings indicated that both ladder drill exercises and zig-zag run exercises produced similar outcomes in terms of enhancing agility in futsal athletes. The creation of a desktop program-based tool for assessing physical and skill tests in futsal sports, as reported by Gumantan et.al [9], underwent extensive expert evaluation. The results showed that sports lecturers gave it a rating of 90%, computer experts in the media field evaluated it at 87%, and Asian licensed trainer practitioners scored it at 90%. With consistent performance of over 80% across all three stages, including the initial trial, small-scale testing, and large-scale evaluation, it can be inferred that this research and development effort has yielded a novel product for measuring sports tests within the field of futsal. As for the study and design of agility measurement system technology with wireless sensor network (WSN) technology as an athlete selection method by Hidayat [10] discusses the study of human agility in running movements so that femur and tibial speed and acceleration data are obtained at different speed variations, namely at walking speed 0.6 m/s (2 km/h) to 1.11 m/s (4 km/h).

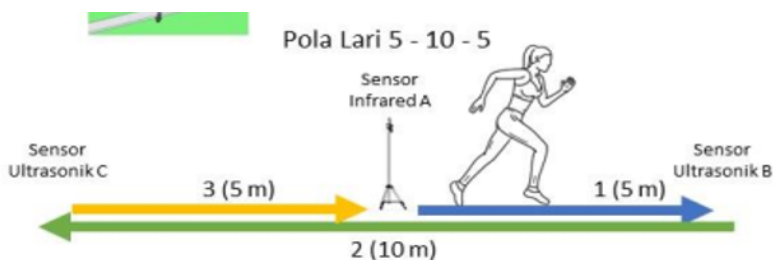
Setya [11] designed a spinning iron test kit for enhancing the striking speed in UPGRI martial arts UKM. The final validation results from experts indicate its high feasibility: material experts provided an 87.5% rating (considered very feasible), media experts rated it at 95% (deemed very decent), and field test athletes scored it at 90.2% (also considered very decent). Consequently, it can be firmly concluded that the spinning iron tool for practicing pencak silat stroke speed is highly suitable for use as a training instrument in pencak silat. Firmansyah [12] created an agility training tool for futsal athletes that utilizes both light and sound, and the research outcomes indicate its effectiveness as a training aid for agility. The validation data from material and media experts placed it within the "feasible" category, achieving an 88.8% rating. Furthermore, evaluations from trainers and players in small-scale trials resulted in an 88.24% rating, also categorizing it as "feasible." Subsequently, in large-scale trials, the tool demonstrated a performance of 92.38%. Syahputri [13] developed a Pencak Silat kick reaction speed training tool with the results of a small-scale trial involving 7 athletes from the Garuda Sakti College showing that the kick reaction speed training tool met the criteria to continue in a large-scale trial because the percentage score of each aspect was between 87.5%-92.42%. The results of a large-scale trial of 15 athletes from the SPDKK college showed that the kick reaction speed training tool met the criteria to continue in the manufacture of mass products because the percentage of each aspect was between 91.67% -95%. It can be concluded that this training tool is urgently needed to make kick reaction speed training more effective and efficient, because it is very important in supporting athlete achievement, besides that the exercise is not boring and becomes input material for pencak silat trainers throughout Indonesia.

Meanwhile, Devi [14], in 2021, a training tool was created to enhance the reaction speed of punches and kicks in karate athletes. The initial trial involved three experts, and

the results were subsequently validated, yielding an average validation score of 87.14%. Another trial was conducted with the second tool, which engaged six experts, and the results were validated, resulting in an average validation score of 90.4%. Drawing from the validation conducted by the six experts, it can be deduced that the development of these training aids to boost reaction speed is valid and suitable for training purposes aimed at improving reaction speed. Ashadi [15] also made a shuttle run tool with data stored in an Arduino-based database with the results of the research showing very good accuracy and accuracy of the tool. The accuracy of the tool is 0.808 (80.8%), with an error presentation of 4.74%. The accuracy of the tool is also very good, namely 0.995 (99.5%), with a standard deviation of 0.33. Meanwhile, the good practicalization test was obtained with a speed of 10.52 seconds, and the less good one was obtained with a speed of 16.39 seconds.

## 2 Methods

In implementing the tool, the step position that the athlete must achieve is according to the layout of the sensor panel placement shown in the following image in Fig.1.



**Fig. 1.** Illustration of an athlete's footsteps during agility training

The implementation of the Alacrity measuring tool is carried out by setting the displacement of the athlete's foot movement based on the touchless sensor in the following order. The athlete's starting position is in the center (sensor A)

Step 1: Run 5 meters towards sensor B

Step 2: Run back 10 meters towards sensor C

Step 3: Run 5 meters to the starting position (sensor A)

So that the travel time of the athlete's position between sensors can be known and it will be recorded by the system in real-time.

## 3 Result and discussion

In the implementation of The Alacrity measuring instrument with the second variation, 10 people were used, consisting of 5 students majoring in sports coaching education, FIK Unesa and 5 students from sports clubs. The results of implementing The Alacrity measuring instrument are seen in the following Table 1.

**Table 1.** Results of implementation of The Alacrity measuring instrument on a limited scale

Atlet	L1 (5m)	L2 (10m)	L3 (5m)	Total
1	2.32	4.13	2.22	8.67
2	1.89	3.76	1.90	7.55
3	1.98	3.98	1.75	7.71
4	2.12	3.81	1.95	7.88
5	1.93	3.95	1.89	7.77
6	1.85	3.65	1.72	7.22
7	2.17	3.82	2.05	8.04
8	2.14	4.15	1.92	8.21
9	2.02	3.91	1.89	7.82
10	2.12	3.99	1.95	8.06
Mean	2.054	3.915	1.924	7.893
Item Varians	0.0212044	0.025205556	0.01996	0.06637
Total Varians				0.153157
Alpha Cronbach				0.849979

Based on the results of reliability calculations using Cronbach's Alpha method, Cronbach's Alpha coefficient value ( $\alpha$ ) = 0.85. Referring to the  $r_{table}$  value with df (0.05, n-2) of 0.632, then  $\alpha > r_{table}$  so that it can be said that the results of the Alacrity measurement are reliable (trustworthy) and classified as very high (good) criteria because it is included in the range  $0.800 \leq \alpha \leq 1,000$ . Based on the description above, it can be said that the data generated by Alacrity is valid (accurate) because all item score correlation values  $> r_{table}$  (0.632). This Alacrity is also equipped with an athlete's movement time tracker while moving from one point to another so that the athlete's performance can be measured according to the desired standards. This makes the coach more focused on observing the athlete's agility movements carefully. Another advantage of this tool is that it is multi-functional because it can be used for athletes of all sports, especially for training agility.

## 4 Conclusion

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