

Assessing Acceleration and Deceleration Phase of Sprinting Event Using Newly Crafted Electronic Device - A Scrutiny

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Abstract: *We are living in a smart world. In This technical era, each and every field was automated by electronic implements with extreme precise, which were tireless to bring out our grit successfully. The present investigator has crafted an electronic gadget to assess the Acceleration and Deceleration Phase of Sprinting Event. These are the most important phases in sprinting event, these segment's performance are the fortitude of sprinting event. Presently acceleration and deceleration skills are not assessing in most of sprint event like district, divisional and state level events due to lack of appropriate devices. The influence of acceleration and deceleration proficiency of the athlete is high on the result of every sprinting event; in this phases quick acceleration and delayed deceleration ability will lead to high performance, hence this is a vital part of every sprinting event. This has led the investigator to craft an electronic device to find out accurate acceleration and deceleration ability of sprinters. The device contained some fundamental parts as 1. Microphone 2. Infrared Transmitters, 3. Infrared Receivers 4. Interfacing Unit and Computer. The outcome of each and every innovation's should have scientific authenticity which is also indispensable at any circumstances. To attain the scientific authenticity of the device, 120 subjects were chosen from Hindusthan College of Engineering and Technology, Coimbatore and the appropriate data were collected using the newly designed equipment when the subjects were participating in the 100m race. The collected data were treated with appropriate statistical techniques and obtained Reliability, Validity and objectivity of the device. Normally in 100mts sprint, starting point to 40mts prevailing as acceleration phase, 40mts to 80mts as flying sprint phase and 80mts to 100mts prevailing as deceleration phase, which is resulting from the international athlete's 100mts sprinting events performances.*

Keywords: Acceleration, Deceleration, Microphone, Infrared Transmitters, Infrared Receivers, Interfacing Unit, Computer, Reliability, Validity and objectivity.

1. Introduction

Technical innovations and allied knowledge remain improving the modern world as unparalleled proportions in every day.

Despite all the arenas gain the benefit of the scientific harmony, the investigator was driven to achieve such innovations in the field of athletics. This different thinking motivated him; consequently this device was invented to assess the acceleration and deceleration ability of athletes in sprinting events.

At present the performance of athletes are assessed by manually operated stop watches, which may not be very perfect, because stop watches are operated by human beings; so the timings will be based on the operating ability of the timer. Hence an Electronic device was crafted with accurate starting and finishing technique to find out split timings of athletes. So we can find out perfect assessment of the sprinter.

2. Statement of the Problem

The purpose of the study was to construct an Electronic device and to attain the acceleration and deceleration ability of all eight sprinters in sprinting event.

3. Delimitations

The Study was delimited in these following factors.

The gadget was created as per the requirement of obtaining acceleration and deceleration ability (Split Time) of sprinters in sprinting events at the respective phases.

120 subjects were used to establish reliability, validity and Objectivity of the device.

4. Limitations

Below cited uncontrollable factors associated with this study accounted as limitations,

- 1) The quantum of physical life, Style, Physiological stress and reaction time, acceleration ability and flying sprint performance of the athletes were considered as limitations.
- 2) The unmanageable changes in climatic conditions and other meteorological factors during the period of testing and their influences on the experimental were considered as limitations.

5. Hypothesis

It was hypothesized that the invented electronic device will be valid, reliable and objective to assessing the acceleration and deceleration ability of the sprinters at the respective phases in selected sprinting events.

Significance of the Study

- 1) This study contributes additional information to the area of research.
- 2) The results of the study would be useful to coaches and administrators to assess the acceleration and deceleration ability of sprinters perfectly.
- 3) This study will help the participants to know their accurate acceleration and deceleration timings.

6. Methodology

Details about the Electronic Device

The following are the primary parts of Electronic Device.

1. IR Transmitter
2. IR Receiver
3. Interfacing Unit
4. Computer

IR Transmitters

The Infra-red transmitter having two different kinds of IC 555, As soon as power fed, they are producing Infra-Red rays and it emitting through the infrared Light Emitting Diode (LED) continuously towards IR receiver in a straight line.

IR Receivers

The IR receivers are having TSO P17 series ICs, which receive the IR rays from the corresponding transmitters continuously. Since the transmitters at various lanes are directly focused towards the corresponding receivers in straight line to receive the IR signal. The IR receivers converting the received IR rays into data signals and sends it to the interfacing unit.

Interfacing unit

This is the vital part of the equipment. This unit contains a special micro controller which is programmed with appropriate timing modules. Whenever the IR receiver gets interruption, special signals passed to this micro controller and it encodes the timing modules. This encoded signals converted as data signals and sending it to the computer which decodes the signals and displays the timings of athletes.

Computer

This is a normal computer, which has special software according to our programme. The computer receives the data signal from interfacing unit and it encoded by the software to displays the exact acceleration and deceleration performance skills of every athlete with precision.

7. Functioning Method

Assessing the acceleration and Deceleration Ability of Sprinters

The IR transmitters and receivers were placed at the 40mts, 60mts and 80mts and 100mts of every lane of 100mts track to find out split timings. The output of the each and every IR receiver was connected with interfacing unit.

When we fed appropriate power supply to the IR modules, the IR transmitters emits IR rays towards the corresponding IR receivers placed over the IR transmitters with straight line. The IR receivers directed the signals getting from IR transmitters to the Interfacing unit. Thus the data signals were encoded by interfacing unit and sent it to the computer for appropriate function.

In the sprinting races, a starting gun was fired to commence the sprint race, simultaneously the athletes were started the race, meanwhile all the eight timers in the computer were started by operating switch on operation. Consequently all 8 track's corresponding timers get operated simultaneously and flashed in the computer screen.

During the race, while the athletes crossing the 40mts, 60mts, 80mts and 100mts (finishing point) the continuously emitting IR rays getting interruption; this interruption is sensed by the corresponding IR receiver and sending it to the interfacing unit. The micro controller of the interfacing unit decodes the interruptions with the corresponding timer. The computer displayed the exact acceleration and deceleration timings of the every athlete.



Figure 1: Assessing method of deceleration proficiency of all athletes

8. Results and Discussions

Computation of descriptive statistics

Testing Period	Mode of Assessment	Mean & SD	Speed Performance		
			Starting to 40mts	40mts to 80mts	80mts to 100m
1	New Device	Mean	3.34	3.42	2.3
		SD	0.18	0.17	0.29
	Stop Watches	Mean	3.18	3.2	2.33
		SD	0.17	0.15	0.28
2	New Device	Mean	3.59	3.29	2.28
		SD	0.25	0.21	0.29
3	New Device	Mean	3.29	3.39	2.32
		SD	0.17	0.19	0.29

The mean values of the subjects' split timings between starting point to 40m during testing periods 1 to 3 are 3.34, 3.18, 3.59 and 3.29 with standard deviations of \pm 0.18, 0.17, 0.25 and 0.17 respectively.

Table above shows the mean values of 40mts to 80mts phases of sprinters. The mean values of the subjects' 40m to 80m during testing periods 1 to 3 are 3.42, 3.20, 3.29 and 3.39 with standard deviations of \pm 0.17, 0.15, 0.21 and 0.19 respectively.

The mean values of the subjects' split timings between 80m to 100m during testing periods 1 to 3 are 2.30, 2.33, 2.28 and 2.32 with standard deviations of \pm 0.29, 0.28, 0.29 and 0.29 respectively.

Reliability of starting point to 40m split time

Analysis of variance with repeated measures for Starting point to 40m split time (sec.) sprint performance

Source	SS	df	MS	F
Subjects	2.874	119	0.024	1.43
Trials	0.004	1	0.004	
Residual	0.339	119	0.0028	

The table value required for significance at 0.01 level of confidence with degrees of freedom 1 & 119 is 4.78.

The above table specifies that the obtained F ratio 1.43 is less than the table value of 4.78 required at 0.01 level of significant. This showed that there is no significant difference between the test and re-test scorers signifying that the process of testing of the starting point to 40mts split time is perfect and consistent.

Source	SS	df	MS _E	R
Subjects	2.874	119	0.002	0.86
Trials	0.004	1		
Residual	0.339	119		

The table value required for significance at 0.01 level of confidence with degrees of freedom 1 & 119 is 0.234.

Hence intraclass correlation was obtained for 40mts split time, which indicates that the obtained intraclass (R) value 0.86 is higher than the table value 0.234 required at 0.01 level of significant. It denotes that the 40mts split time

assessed by the device during the test and re-test are significantly related.

The above results proved that the newly constructed electronic device is reliable to assess the 40mts split of sprinters.

Reliability of Split Time from 40m to 80m

Analysis of variance with repeated measures for split time from (sec.) Sprint performance

Source	SS	df	MS	F
Subjects	9.952	119	0.084	1.37
Trials	0.019	1	0.011	
Residual	0.953	119	0.008	

The table value required for significance at 0.01 level of confidence with degrees of freedom 1 & 119 is 4.78.

Table indicates that the obtained F ratio 1.37 is less than the table value of 4.78 required at 0.01 level of significant. This proved that there is no significant difference between the test and re-test scorers indicating that the process of testing of split time from 40m to 80m is perfect and consistent.

Intraclass correlation for split time from 40m to 80m (Sec.)

Source	SS	df	MS _E	R
Subjects	9.952	119	0.009	0.92
Trials	0.019	1		
Residual	0.953	119		

The table value required for significance at 0.01 level of confidence with degrees of freedom 1 & 119 is 0.234.

Table indicates that the obtained intraclass correlation (R) value 0.92 is higher than the table value 0.234 required at 0.01 level of significant. It denotes that the split timings from 40m to 80m recorded by the device during testing and re-testing periods are significantly related.

The above results proved that the newly constructed electronic device is reliable to assess the split timings from 40m to 80m of sprinters.

Reliability of 80mts to 100m split time

Analysis of variance with repeated measures for 80mts to 100m split time (sec.) sprint performance

Source	SS	df	MS	F
Subjects	18.943	119	0.159	1.14
Trials	0.008	1	0.008	
Residual	0.920	119	0.007	

The table value required for significance at 0.01 level of confidence with degrees of freedom 1 & 119 is 4.78.

The above table specifies that the obtained F ratio 1.14 is less than the table value of 4.78 required at 0.01 level of significant. This showed that there is no significant difference between the test and re-test scorers signifying that the process of testing of the 80mts to 100mts split time is perfect and consistent.

Intraclass correlation for split time from 80m to 100m (sec.)

Source	SS	df	MS _E	R
Subjects	18.943	119	.0085	0.89
Trials	0.008	1		
Residual	0.920	119		

The table value required for significance at 0.01 level of confidence with degrees of freedom 1 & 119 is 0.234.

Hence intraclass correlation was obtained for 80mts to 100mts split time, which indicates that the obtained intraclass (R) value 0.89 is higher than the table value 0.234 required at 0.01 level of significant. It denotes that the 80mts to 100mts split time assessed by the device during the test and re-test are significantly related.

The above results proved that the newly constructed electronic device is reliable to assess the 80mts to 100mts split times of sprinters.

Validity of split time starting point to 40M

Pearson product moment correlation for Split time starting point to 40m (sec.)

Mode of Assessment	Mean	SD	r
New Device	2.21	0.21	0.91
Stopwatch	2.81	0.80	

The table value required for 2 & 118 degrees of freedom at 0.01 level of significant is 0.236

The table indicates that the obtained correlation value 0.91 is higher than the table value 0.236 required at 0.01 level of significant. It denotes that the split timings taken from starting point to 40m using the newly constructed electronic device and stopwatches simultaneously are significantly related.

The above results proved that the newly constructed electronic device is valid in assessing the split timings from starting point to 40mts of sprinters.

Validity of split time from 40m to 80m

Pearson product moment correlation for Split time from 40m to 80m (sec.)

Mode of Assessment	Mean	SD	r
New Device	2.41	0.39	0.88
Stopwatch	2.63	0.59	

The table value required for 2 & 118 degrees of freedom at 0.01 level of significant is 0.236

The table indicates that the obtained correlation value 0.88 is higher than the table value 0.236 required at 0.01 level of significant. It denotes that the split timings from 40m to 80m using the newly constructed electronic device and stopwatches simultaneously are significantly related.

The above results proved that the newly constructed electronic device is valid in assessing the split timings from 40mts to 80mts of sprinters.

Validity of Split Time from 80m to 100m

Pearson product moment correlation for split time from 80mts to 100m (sec.)

Mode of Assessment	Mean	SD	r
New Device	2.41	0.26	0.89
Stopwatch	2.43	0.29	

The table value required for 2 & 118 degrees of freedom at 0.01 level of Significant is 0.236

Table indicates that the obtained correlation value 0.89 is higher than the table value 0.236 required at 0.01 level of significant. It denotes that the split timings from 80mts to 100m by using the newly invented electronic device and stopwatches simultaneously are significantly related.

Objectivity Starting Point to 40m Split Time

Analysis of variance with repeated measures for starting point to 40m split Time (sec.)

Source	SS	df	MS	F
Subjects	2.78	119	0.023	1.70
Trials	0.30	2	0.15	
Residual	1.85	238	0.008	

The table value required for significant at 0.01 level of confidence with degrees of freedom 1 & 119 is 4.78.

The table indicates that the obtained F ratio 1.70 is less than the table value of 4.78 required at 0.01 level of significant. This proved that there is no significant difference among three different testers. It reveals that, the process of testing the split time from starting point to 40m is perfect and consistent.

Intraclass correlation for split time from Starting point to 40m (sec.)

Source	SS	df	MS _E	R
Subjects	2.78	119	0.008	0.72
Trials	0.30	2		
Residual	1.85	238		

The table value required for significant at 0.01 level of confidence with degrees of freedom 1&119 is 0.234.

The above table indicates that the obtained intraclass (R) value 0.72 is higher than the table value 0.234 required at 0.01 level of significant. It denotes that the split time from starting point to 40m recorded by the three testers using the newly constructed electronic device at three different periods are significantly related.

Objectivity of Split Time from 40m to 80m

Analysis of variance with repeated measures for split time from 40m to 80m (sec.)

Source	SS	df	MS	F
Subjects	30.86	119	0.259	0.48
Trials	0.008	2	0.004	
Residual	2.403	238	0.01	

The table value required for significant at 0.01 level of confidence with degrees of freedom 1&119 is 4.78.

Table indicates that the obtained F ratio 0.48 is less than the table value of 4.78 required at 0.01 level of significant. This proved that there are no significant differences among three different testers. It reveals that the process of testing the split time from 40m to 80m is perfect and consistent.

Intraclass Correlation for Split Time From 40m To 80m (Sec.)

Source	SS	df	MS _E	R
Subjects	30.86	119	0.011	0.94
Trials	0.008	2		
Residual	2.403	238		

The table value required for significant at 0.01 level of confidence with degrees of freedom 1&119 is 0.234.

Above table indicates that the obtained intraclass (R) value 0.94 is higher than the table value 0.234 required at 0.01 level of significant. It denotes that the split time from 40m to 80m recorded by the three testers using the newly constructed electronic device at three different periods are significantly related.

The above results strongly proved that the newly constructed electronic device possess objectivity to assess the split time from starting point to 40m, 40m to 80m and 80m to 100m of sprinters on the track simultaneously for eight athletes.

Objectivity 80mts to 100m split time

Analysis of variance with repeated measures for 80mts to 100m split Time (sec.)

Source	SS	df	MS	F
Subjects	30.98	119	0.26	1.14
Trials	0.018	2	0.009	
Residual	2.098	238	0.008	

The table value required for significant at 0.01 level of confidence with degrees of freedom 1&119 is 4.78.

The table indicates that the obtained F ratio 1.14 is less than the table value of 4.78 required at 0.01 level of significant. This proved that there is no significant difference among three different testers. It reveals that, the process of testing the split time from 80mts to 100m is perfect and consistent.

Intraclass correlation for split time from 80mts to 100m (sec.)

Source	SS	df	MS _E	R
Subjects	30.98	119	0.021	0.88
Trials	0.018	2		
Residual	2.098	238		

The table value required for significant at 0.01 level of confidence with degrees of freedom 1&119 is 0.234.

The above table indicates that the obtained intraclass (R) value 0.88 is higher than the table value 0.234 required at 0.01 level of significant. It denotes that the split time from 80mts to 100m recorded by the three testers using the newly constructed electronic device at three different periods are significantly related.

Analysis of Data and interpretation of the study

The main purpose of this study was to craft an electronic device to assess the acceleration and deceleration ability of the sprinters at the respective phase and also to establish scientific authenticity of the instrument.

The setting up of scientific authenticity involves establishment of reliability, validity and objectivity.

Reliability was established by test and retest method. The obtained two sets of scores were subjected to univariate correlation procedure and Reliability was established

Validity was established by the Data were collected using the stop watches along with the newly constructed equipment and data were collected from the same subjects. Using these two sets of data, Pearson Product moment correlation was applied and coefficient of correlation was found out and the validity of the instrument was established.

Objectivity was established by collecting data using the same subjects and the same instrument, also similar conditions were provided but two different testers have collected the data. Thus two sets of scores were obtained and they were subjected to univariate correlation procedure which indicating that 89% association between these scores.

9. Conclusion

It is concluded that the device is more Valid, reliable and objective to assess the acceleration and deceleration ability of sprinters.

10. Recommendation

New Equipment may be crafted to evaluate the reading of other track and field events.

Similar gadget may be designed to measure various motor fitness components.

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