Design Of Instrument Explosive Power Leg Muscles Sensor Based

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Abstract. Explosive power is an important factor in sports. The aim of this research is to design a sensor-based leg muscle explosive power instrument that is suitable with the characteristics of the explosive power, which has a working unit kg.m / s, and instruments that are effective, efficient and economical. Development research was carried out by adapting the Borg & Gall model. This study involved 4 experts as validator tools for validation tests namely tests and measurements, exercise physiology, training science and IT. Data collected using a questionnaire. The results obtained from expert validation are an average percentage of 91%. The conclusion of this study is that the design and work of the developed instrument is acceptable or feasible to be developed.

1. Introduction
There are four basic components, namely natural achievement, physical condition, techniques, tactics and mental [1]. Condition (physical condition) in general can be interpreted by a state or physical ability [2]. Leg muscle power is one of the physical aspect is very important to support sporting achievements. Explosive power is often used a variety of techniques [3]. Sports that require limb muscle power both individual sports, as well as permaianan.

Achievement is determined by the coaching and training. The problem is the ideal development patterns have not been optimally utilize technology [4]. Similarly in the case of leg muscle explosive power measurement. The basic concept of measurement using the Vertical Jump Power tugkai measures the difference between the beginning and the achievement of the final achievement by performing vertical leap. Seeing the current globalization era there are some tools that can measure the Power of leg muscle that has been based on technology is a measuring tool for Power limbs among others Jump DF and Force Plate [5]. But in fact chose more conventional way to measure is by using the Power leg Vertical Jump.

Vertical jump test is a fitness test used to determine the strength of leg muscles or explosive (explosive power) an athlete. This test is often used by professional athletes, especially to determine the development of an athlete during training. The higher the jump, the stronger leg muscles / explosive an athlete [6]. Power or explosive test is a test used to measure power, including the Vertical Jump is done electrically or manually aim to measure Power limb muscles upwards by [7-8]. These tools work unit is kg-m / sec. Where seen explosive power component is composed of body composition (kg) tempu distance (m) and the timing of the motion (seconds). This test is often done due to easy, efficient and can be done anywhere. But the problems that happens is, in the implementation of each component is not observed (weight, distance and time of execution). So that the data obtained are less accurate. And therefore need innovation in these tests with a touch of technology and digitization. Understanding simply digitalilasi a whole series elektroik components in one unit that has a special function that creates a new process but easy to automation and programs.
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This study will generate instrument product Vertical Jump with Lewis digitally nomogram calculations to take advantage of the sensor. Digitalasasi process by assembling several components. Luarannya data generated in the form of numbers mempu predict the ability of leg muscle explosive power testee. Data retrieval weight difference Raihan vertical leap that will convert into the formula nomogram lewis and generate data output leg muscle power. Then the output data will be displayed on the LCD screen display so that the subject can measure directly recording data in the form of leg muscle power results dimensionless (kg-m / Sec).

2. Method
This type of research and development (Research and Development) to adopt the model of the Borg and Gall. Data collected by means of an expert study. Specialists involved in the expert assessment of the instrument designed by experts consisting of: IT Experts (on the working procedures of tools, devices and system components used oprasi), Expert Evaluation and measurement test of sports and sports physiology experts. Data were analyzed using frequency distribution.

3. Results and Discussion
In accordance with the purpose of this research is to develop an instrument berbasi leg muscle explosive power sensors. The end result of this research is a form of instrument design is developed. Implementation of Thapan-stage research through research denganmodel sesuai menadaptasi floating the Borg and Gall. Here is a description tool developed

1. Equipment specifications
   Instruments developed with a variety of electronic components. Here is a component developed
   a. LCD. Working Principle Convert the data in the form of numbers and letters look An integrated on the microcontroller to function as a data viewer function either in the form of characters, letters, numbers or graphs
   b. Sensor working UltrasonicPRinsip censorshipSN-SR04T Module Ultrasonic Distance Measuring Transduceris the flying time span system that is integrated into compact modules. By providing ultrasonic wave and serves as a component in the achievement of high data input in meters
   c. Scales Load Cell with the working principle Convert forms of pressure in Kg units that integrate the microcontroller as a reference for weight loss results and serves as a data input weight
   d. Flat cap with the working principle Teste be worn on the head in order to optimize the reflection flat plane gelompang Ultrasonic and serves as as a tool in leaps and achievement data retrieval,
   e. Tripot with working prisnip Penunjang tool in menintegrasli all components so smoothly by adjusting the height as needed and serve as a tool tripod so that all components can stand and adjust the height teste to be measured.

2. How to Work tool
   a. Prepare the tool in a location that can supply electrical energy source and flat as a place of establishment of the tools and the establishment of teste
   b. Establish TriPort and set a low altitude in order to facilitate the assembling tool
   c. Set on truport buffer to form a 90 degree angle as a place to put the ultrasonic sensor
   d. Enter TriPort tehingga LCD on the pole into a single unit
   e. Put timbanga Load Cell lying flat and not too far from the existing TriPort
   f. Put the ultrasonic sensors on the top of the TriPort which has been formed by an angle of 90 degrees
   g. Adjust the height of TriPort back to high enough perceived more or less with a height of 3 meters
   h. Connect the power supply to the electric current and the LCD display
   i. Wait until the indicator on the LCD screen to perform perfectly and appear red lesrer point,
   j. Create a clear area to jump using the marker (can carp, markers or other)
   k. The tool is ready for use
3. Final design of the instrument

![Figure 1. Layout Instrument](image)

Research data
In accordance with the purpose of the study, the data will be displayed in this study is a response or expert opinion on the instruments developed. Here is a recapitulation tabulation and expert opinion

| No. | Specialists     | F  | N  | (%)  | Category Eligibility               |
|-----|-----------------|----|----|------|-----------------------------------|
| 1   | TPO experts     | 159| 85 | 94%  | Very Good / Worthy                |
| 2   | FAAL Experts    | 137| 75 | 93%  | Very Good / Worthy                |
| 3   | IT Experts      | 136| 85 | 95%  | Very Good / Worthy                |

From the data obtained, it is known each expert provides an assessment instrument developed at a decent category. So that in principle, an instrument developed memiliki declared invalid a good level. Validity validity comes from the word that means the extent to which the accuracy and precision of measurement (test) in doing the measuring function [10]. The validity of this research is a form of construct validity. Where this is the mengunggungkup validity of expert opinions related to what developed. In this case the development of leg muscle explosive power instrument based sensors.

4. Conclusion
Based on the results of data processing and analysis of data the research that has been done, the development of digital-based instruments Vertical Jump is concluded that the tool be valid in the category worthy of 3 validator expert with the calculation of the average percentage of 91%. The instrument can be declared to have a high degree of validity and can be used in the measurement of leg muscle explosive power.

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