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DEVELOPMENT OF A DIGITAL-BASED PUSH UP AND SIT UP TEST COUNTER

Romi Mardela[1], Roma Irawan[2], Anak Agung Ngurah Putra Laksana[3], Yurmianna Marlina[4], Ridwan Ependi[5]
Universitas Negeri Padang[1,2,3,4], Universitas Pendidikan Ganesha[2]
mardela@fik.unp.ac.id

Abstract
Based on the needs analysis carried out using the observation need analysis, it was found that the respondents answered with a very high level of need. Therefor this study aimed to develop a test instrument for counting push up and sit up test in one tool that is digitally integrated. The test tool was developed using the Arduino program with an ultrasonic sensor system and displays the counting results of push-up and sit-up test via the LCD. Content validity is used to test the instrument by using professional judment and involving experts in media, sport test and measurement, liguists, and physical conditioning. Then for the small group test of student to push up 110 (boys and girls) and sit up 124 (boys and girls). Data analysis to test the validity of the expert group using percentages, and test the sample group using the product moment correlation formula. The results of the data obtained from the validity test of the tool expert group to measure the ability to push up and sit up were declared feasible. Then, a small group of push-up was stated valid (rcount 0.991 > rtable 0.195) and sit-up also declared valid (rcount 0.866 > rtable 0.147). This study still has weaknesses, especially in the limited number of samples and the quality of movement cannot be controlled through tools, therefore future researchers can increase the number of samples and including other components to assess movement quality.

Keywords: *Measuring Instrument; Push Up; Ultrasonic Sensor; Arduino; Digital; and Manual*

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Correspondence Author: Romi Mardela, Universitas Negeri Padang, Indonesia.
E-Mail: mardela@fik.unp.ac.id

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INTRODUCTION

Sport is one of the important and necessary activities in human life, because the sport itself is an activity or physical activity that is carried out regularly, repeatedly, intending to improve body/physical fitness (Alba et al., 2019). According to (Mardela, et al, 2019) stated that "Sport is an inherent part of human cultural heritage, sport also does not solely seek freshness but also to get

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the highest appreciation to raise the dignity of the region or nation". Following the Law of the Republic of Indonesia Number 3 of 2005 concerning the National Sports System, which states that, "Sport is all systematic activities to encourage, foster, and develop physical, spiritual and social potential".

According to (Fauzal and Alnedral, 2019) "The development of sports has become a necessity to maintain and improve physical conditions in carrying out physical activities and achieving achievements". In the Law of the Republic of Indonesia Number 3 of 2005 concerning the National Sports System it is stated in Chapter 1 Article 1 Paragraph 13 that: "Achievement sports are sports that foster and develop athletes in a planned, tiered and sustainable manner through competition to achieve achievements with the support of sports science and technology. Yusuf, 2020) argues that "The success of the achievements displayed by an athlete in a competition is determined and influenced by the ability or potential of the athlete himself. Increasing achievement is also supported by various factors such as physical condition, technique, tactics, mentality, coaches, facilities and infrastructure, athlete status, nutrition, and mentality which are important aspects in efforts to achieve maximum achievement (Argantos, 2017). Furthermore, technology is also one of the driving factors in achieving achievement as stated (Prabowo, 2019) "Another factor that can affect achievement is existing technological advances". And everything can be obtained through a touch of technological developments in the field of sports that can be used by all sports players (Pratama et al., 2022).

Technology is also a means to make it easier for coaches or athletes to know their level of ability because in general physical conditions can be a strong basis for achieving achievements through the tools developed. Technological developments in the field of sports can also be a medium that can support sports measurement (Putra et al., 2020). Sports tests and measurements are also inseparable from the physical condition of athletes, and sports players, especially out there, have used and developed tools that can measure the physical condition

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of athletes for achievement and the aspect of physical condition that is prepared is strength because strength is a major factor in almost all sports. . This is because, if in a measurement using technology it can minimize the occurrence of errors (human errors) that are made when collecting data.

In sports, technology has an undoubtedly significant impact, including how the process of digitizing tools is one form of technological development in the field of sports. In the Big Indonesian Dictionary (KBBI) Digitalisation is the process of giving or using a digital system. Furthermore, according to Fuad in (Prabowo, 2019) "Digitalization is a process in which a product is mixed with various kinds of electronic components that have an energy source from electricity or other fuel energy that is formed from a circuit to create a new process but made easier by automation and programs that have been input from a software into a hardware ". (Nylen, 2015) states "One of the advantages of digitization is that digital products and services are not only efficient to use and easy to learn but also enrich the user experience, while the drawback is the programming process which is prone to errors if there are errors in its use". In addition, the digitalization process is also included in the development of technology-based science where the tools to be created cannot be separated from electronic circuits and developing technologies.

Tests that are carried out manually are not maximally able to provide objective results, this also happens because of the limitations of the tests that are still done manually. With the existence of a digital-based test kit, it will certainly facilitate the process of carrying out the test. Therefore it is necessary to create and develop a technology-based push-up test instrument. The developed tool uses software (software) using arduino and hardware (hardware) using ultrasonic sensors and other components that can be used as test instruments. Until now, there are many types of Arduino used. Ranging from simple to complete and already using ARM Cortex in the form of a PC (Ghunaifi, 2017). However, the most widely used is the Arduino Uno. Arduino is an open source microcontroller

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or single board microcontroller derived from the wiring platform designed to facilitate the use of electronics in various fields (Crismondari, 2020). Arduino is an open source microcontroller that can be easily programmed, uninstalled and reprogrammed at any time if needed (Louis, 2016). Arduino Uno is equipped with a 16 Mhz oscillator, a USB port, a DC power jack, an ICSP header, and a reset button (Badamasi, 2014). Ultrasonic sensor is a sensor that converts physical quantities into electrical quantities, and vice versa. In general, ultrasonic sensors are used as radars to search for the presence of an object by estimating the distance of the wave from the object (Carullo and Parvis, 2001). Liquid crystal display (LCD) is a type of electronic display that is useful for displaying data in the form of letters or numbers. According to (Ahmad et al, 2015) in Prosisko Journal Vol. 2 No. 1 says the Arduino microcontroller board is a module that uses the ATmega328 microcontroller and uses a more sophisticated series, so it can be used to build electronic systems that are minimalist in size but reliable and fast. Various modules and the latest sensors can be installed on this board, complete with various satisfying demo codes. This tool is expected to help and facilitate the calculation of push-up tests to be carried out, both for learning measurement test courses and also for achieving local and international achievements in the future as well as the development of science and technology in the field of sports.

METHOD

This type of research is descriptive research,which aims to express something as it is.This research was conducted at several Silat Colleges in Padang City and also at Padang State University.The time of this research was carried out in the monthJune to July 2021. The target of this research is the martial arts athlete of Padang Citynamely athletes from the Setia Hati Terate College (Jl. Dadok Tunggul Hitam), the Empat Banding Budi College (Padang City Cultural Park) and the Tangan Mas College (MTs Ti Batang Kabung) and students who are currently taking swimming courses.The sampling technique uses Accidental

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Sampling, namely the sample used is the total number of athletes who were at the research location when conducting the research. This research instrument uses a calculator¬Push-Ups and Sit-Upsdigital-based whose feasibility has been tested by three experts, namely: Tool/Media Expert, Measurement Test and Physical Conditions.

Instrument Tool Making

In the process of making tools consists of several processes, viz Tool Design The following is a tool design that has been designed to calculate push up and sit up tests. This tool consists of a proximity sensor to calculate every push-up and sit-up movement whose results will be displayed on the LCD.

Figure 1. Tool Mechanical Design

Component Provision

The following are the components contained in the push up and sit up test kits:

1. *Displays*function to show the results of tests performed
2. The electronic circuit box functions as a support as well as a framework for the push-up test measuring device.
3. Proximity sensor functions as a measuring instrument detection tool
4. Tool Making

Arduino programs

a) Menus That Are Created And Programmed For Digital Push Up, Sit Up Calculator Tools
b) sensor pin settings
c) button pin settings
d) If the White Button is Pressed
e) Options Screen Display

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f) Screen Display When Selected

The programs created for the Push-Up menu components are as follows;

a) Components of the Push Up Menu
b) A program that has been created and applied by a component, namely Arduino
c) Sensor Pin Settings
d) Button Pin Settings
e) If the White Button is Pressed
f) Options Screen Display
g) Screen Display When Selected

The programs created for the Sit-Up menu components are as follows;

a) Sit-Up Menu Components
b) A program that has been created and applied by a component, namely Arduino
c) Sensor Pin Settings
d) Button Pin Settings
e) If the White Button is Pressed
f) Options Screen Display
g) Screen Display When Selected

Tool Use Procedures

1. The stage of using the developed test kit is to connect the adapter to the PLN power source.
2. After the device is connected and turned on, a menu selection of push-up and sit-up tests will appear.
3. Then press the blue button, if pressed once a warning will appear for sensor stability. Meanwhile, if you press it a second time, the tool will start counting automatically for 60 seconds.
4. After 60 seconds the tool will automatically stop with the END display on the LCD,
5. And finally press the white button to return to the main menu display.

Push Up Implementation Procedures

1. The procedure for carrying out the push-up test uses the tools that have been designed, namely first the push-up test calculation tool is placed in front of the testee.
2. *Testee*take a ready position to do push ups (testee ready position is when the testee's hands, head, body, and legs are in the lower position).
3. Next, the Testee does a push-up movement by lifting the body, hands and head in an up and down position.
4. The sensor will start to do an automatic calculation when the testee's body starts doing the push-up movement, the sensor will automatically count the

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number of push-up tests when the blue button on the tool is pressed and after there is a push-up movement and will stop when it reaches 60 seconds.
5. Every time the testee's body passes through the sensor, one push-up will be counted and the results of the test will be displayed on the LCD connected to the device.

Sit Up Implementation Procedures

1. First, the sit up test calculation tool is placed in front of the testee. Then the testee takes a position ready to do sit ups.
2. Next Testee does a sit up movement
3. When the blue button on the tool is pressed, the sensor will start performing automatic calculations. When the testee's body starts doing sit-up movements, the sensor will automatically calculate the number of sit-up tests.
4. The sensor will automatically stop when it reaches 60 seconds.
5. Every time the testee's body passes through the sensor, one sit-up will be counted and the results of the test will be displayed on the LCD connected to the device.

Data collection technique

Data collection was carried out twice, namely the first tool validation test by tool/media experts (Dr. Donie S.Pd., M.Pd and Risferendra Ph.D), measurement test experts (Dr.H Arsil M.Pd), and a physical condition expert (Dr. Ronni Yenes M.Pd) and a linguist (Vani Afrilia M.Pd) and both tested test kits in small groups.

RESULT AND DISCUSSION

The result of this research is the creation of a feasible and valid push-up test calculation tool which is equipped with an ultrasonic sensor with an arduino system displayed on the LCD. This tool aims to count the number of push-ups and movements*sit ups*performed for 60 seconds and the results can be displayed on the LCD.

Figure 2. Product Results

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Furthermore, a feasibility test was carried out on expert lecturers to determine the level of feasibility of the tools that had been made. And a small group test was carried out to determine the validity of the tool that had been made.Based on the feasibility test of the tool with validation of three experts, the following results were obtained;

Table 1. Expert Due Diligence

1	Rated aspect	Earned Score	Max Score	Percentage %	Category
1	Tools/Media	44	50	88	Worthy
2	Measurement Test	40	40	100	Worthy
3	Physical condition	42	45	93.33	Worthy

The results of the validity of the small group test using a digital-based push-up counting tool, the results of the push-up ability in the small group test of 43 people, namely Rcount>Rtable, are declared valid;

Table 2. Validity Results

Test Results	Rxy	Rtable	Status
Digital	1	0.266	Valid

Product Description

Development of a tool for calculating push-up and sit-up tests in the form of a tool used to measure push-up and sit-up abilities using measurement media in the form of ultrasonic sensors with an Arduino system that is very suitable for measuring push-up and sit-up abilities. This development product was developed to provide accurate results in the implementation of push ups and sit ups, and is expected to be used as a reference in increasing the push up and sit up abilities of athletes in the long term training process. This push up and sit up test tool is formed using an aluminum frame formed with legs as the support for the box. Then on the frame there is also a box (box) containing the Arduino program that runs the work process of the tool as well as the LCD as the main screen which is small in shape which is capable of displaying the number of push up and sit up

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tests carried out, also displays the running time automatically for 60 seconds. Furthermore, in this tool there are two sensors placed above the box and below the box on an aluminum frame with a distance of 15.5 cm, the distance between the top sensor to the floor is 50.5cm, the sensor below to the floor is 28cm and the distance between the tool and the testee is a maximum of 30cm so that sensor can work as it should.

DISCUSSION

In sports, the endurance of arm muscle strength is needed because it can help a person to be able to do repetitive movements continuously. The endurance of arm muscle strength greatly determines whether or not the technique of hitting in martial arts such as the sport of pencak silat. So further research was carried out which led to a test kit that was able to calculate the endurance of arm muscle strength through the push up test (Arisman & Noviarini, 2021). Starting from tool validation and tool validation testing through small group tests (Okilanda, 2017).

From the results of the validation assessment with three expert lecturers, the digital-based push-up test calculation tool obtained the result that the tool was "Decent". When validating the tool, several comments were obtained that support further refinement of the tool, such as adding sensors that are able to detect the testee's movements so that the movements carried out are in accordance with the implementation rules (Nopianto et al., 2020). Then regarding the time setting in the tool so that it can be adjusted according to the desired time requirements so it's not based on just 60 seconds, it can be adjusted according to other needs. And lastly so that the tool can directly measure the validity and reliability of the tool through the movements made (Okilanda et al., 2021).

According to (Aziz, 2008) "Related to the suitability or accuracy of measurement between the measuring instrument and the object being measured; validity implies measuring what should be measured or the extent to which the measuring instrument describes the accuracy in measuring what should be measured (Ihsan et al., 2022) (Taufik et al., 2021). The way to measure validity is

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by operationally defining the concept to be measured until a measuring instrument is composed, namely through the stages of testing, tabulating and statistical testing with the "Product Moment" correlation. In this study, the researcher used the first method, namely the method of testing the tool through a small group test of 43 people which was carried out with one try and the test result data were divided into digital and manual data.

From the calculation results using the existing formula, then the data results are matched using the first validity formula, then the results of the validity of the tool are obtained with the "Valid" category. In this study there are also several limitations, namely First, the tool must still use an electric power source, it is hoped that for further research it will be able to use batteries as the main resource or can also use a power bank. Second, the tool has not been able to detect the correct push-up movement so that inaccurate data can still occur. It is hoped that for further research a sensor can be added that can detect the correct push-up movement (Marta & Oktarifaldi, 2020).

CONCLUSION

Based on the results of data processing and analysis of the research data that has been carried out, it can be concluded that the validation of the three experts states that the tool is in the "Decent" category. Furthermore, the validation of the tool based on small group trials obtained data results in the "valid" category.With the results obtained on the tools made, this can be a guideline for better research in the future coupled with developments carried out by subsequent researchers.

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