



DETECTION OF MUSCLE STRENGTH SIGNAL WITH PROGRESSIVE MUSCLE RELAXATION EXERCISE BASED ON ARDUINO UNO ON THE ELDERLY IN INDONESIA

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Abstract

Objective: To identify the muscle strength detection signal with progressive muscle relaxation based on Arduino Uno on the elderly. **Method:** An experimental method with one intervention group on 39 respondents over 45 years of age was used. Furthermore, data analysis was carried out using demographic data and observation sheets based on Arduino UNO connected to a smart phone. **Result:** The results showed that 21 male respondents (53.8%) and 18 female respondents (46.2%) received Arduino UNO-based progressive muscle relaxation training intervention with 10 treatments every day. This exercise was carried out routinely meanwhile, productive activities were given to 21 elderly respondents (53.8%) and unproductive activities to 18 respondents (46.2%). **Conclusion:** Detection of muscle strength with progressive muscle relaxation based on Arduino UNO is identifiable with a sensor value of 5.0/1023.0 volts.

Keywords: Detection, Muscle Strength, Progressive Muscle Relaxation, Exercises, Elderly, Arduino UNO

Introduction

A gradual and continuous process of natural change that begins in early adulthood. Changes with a gradual decrease in bodily functions¹. The number of elderly individuals in the world is estimated to be over 629 million (1 in 10 people are over 60 years old), and to reach 1.2 billion by 2025². The Ministry of Social Affairs stated that the number of elderly people (elderly) in Indonesia is more than 10% of the population in 2020, where the total population in the country reaches 269.9 million people³. Human activities such as eating, drinking, bathing, walking and sleeping are supported by the muscles.

Therefore, they tend to experience problems when activities are not carried out continuously. This is because as the muscle exerts more power, it produces a greater frequency⁴. Developments in this modern era require medical equipment capable of detecting the electrical impulses in human muscles where an analysis of the electromyography signal amplifier circuit will be carried out

detecting the electrical impulses in human muscles where an analysis of the electromyography signal amplifier circuit will be carried out⁵. Research studies related to design Microcontroller Based Electromyograph (EMG) for Detecting Muscle Injuries to the Ankle (Ankle) using components consisting of three electrodes, AD8232, Arduino Uno, and Laptop or PC⁶. The initial processes of muscle stress include polarization (tensed muscles), depolarization (relaxed muscles) and repolarization (resting phase)⁷. Therefore, the stress reaction is read on the Arduino UNO circuit that has been affixed to the muscle skin and the output signal produced will be sent via Bluetooth HC-05 connected to Android with energy through a power bank.

Furthermore, the arduino UNO-based muscle strength detection tool will be linked to muscle signals during progressive muscle relaxation training in the elderly. A method capable of reducing muscle tension by carrying out muscle relaxation exercises and adjusting breathing consistently for 15 minutes was used⁸. In addition, progressive muscle relaxation



techniques are used to reduce fatigue, muscle cramps, neck and back pain⁹.

Method

An experimental method with one intervention group which was carried out on 39 respondents over 45 years of age was used. This method was carried out by designing a system for detecting muscle strength based on Arduino UNO and testing whether the signal will be properly identified. This study was carried out in Medan Sunggal sub-district by involving two set of environments, namely environment II and III.

The design of the system for detecting muscle strength based on Arduino UNO is shown below.

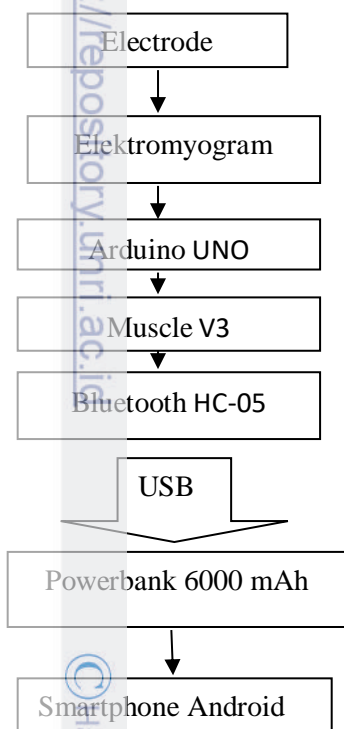


Figure 1. Diagram of Arduino UNO-based Muscle Strength Detection System Design

Results

Table 1

The characteristic of respondents' demographic data was detection of muscle strength in progressive muscle relaxation training based on Arduino Uno in Medan Sunggal, Indonesia.

Demographic data characteristic	n	(%)
Age		
45 – 49 year old	11	(28.2)
50 – 54 year old	7	(17.9)
55 – 59 year old	6	(15.4)
60 – 64 year old	7	(17.9)
Over 65 years old	8	(20.5)
Gender		
Male	21	(53.8)
Female	18	(46.2)
Work Activity		
Elderly	21	(53.8)
Productive	18	(46.2)
Non – Productive		

The majority of the data used comprised of 11 respondents within the age range of 45-49 years (28.2 percent). Furthermore, productive activities such as working were given to 21 respondents (53.8 percent) and the male gender comprised of 21 respondents (53.8 percent) as well.

Table 2

The results of muscle strength detection in progressive muscle relaxation training based on Arduino UNO



This strength detection test generated a signal when carrying out activities and the resulting mean limit of the tool was 5.0/1023.0 volts. Furthermore, the detection of muscle strength consisted of 3 phases namely polarization, depolarization and resting phase, which was seen from the rising, falling and stable signals. However, when a respondent has muscle problems, this detection cannot be read. The mechanism for generating electrical signals in



the muscles is related to the motor unit and the number of unique motor muscles varies from 100 to 1000. In addition, variation of the resulting motor unit varies, depending on the signal being carried¹⁰.

Discussion

Loss of muscle strength with age often results in a decrease in maximal joint torsion and strength, which leads to weakness in the lower limbs. This weakness is not entirely due to loss of muscle mass but 6 - 10 percent is caused by impaired strength and increased muscle mass in the elderly¹¹. Therefore, electromyography was able to analyze motor units, changes in the maximum motor unit rate and strength stability². This electrical activity occurs in all parts of the body both in the brain, muscles, and the heart. The frequency of each activity will be different, this can be known by the electrodes placed on the skin. Results of a series experiment EMG The frequency of each movement made by the hand muscles is all different. Function from EMG can be used to determine diseases that exist in the human nervous system and can be used as a control to control the tool. Average amplitude value obtained after going through a series of electromyography (EMG), namely when in 46 a relaxed state is 2.63880 Volt when the hand clenched 2.25289 Volt when the hand opens 1.6381 Volt, right hand open and left hand clenched 1.16864 Volt and when the right-hand clenches and the left hand opens 1.23486 Volt. The hand position when is under the potential will be greater than the hand above so that in this study the amplitude value when relaxed is greater⁴. In study, the biological signal for the condition of the arm muscles using the median frequency method as an identifier of the fatigue signal using the Myo ware muscle sensor to detect signals in the biceps brachi muscle, Arduino UNO as an ADC (analog to digital converter) and serial communication with a laptop. In software, there is a Serial Oscilloscope as a signal viewer resulting from serial communication between Arduino and a laptop and also as a signal recorder, and MATLAB as a signal processor for the recorded frequency spectrum using the

FFT (fast Fourier transform) method, the signal is then searched for the median frequency and displayed on the graph¹³.

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Conclusion

Arduino uno-based muscle strength detection can be carried out on progressive muscle relaxation exercises with amplitude of 5.0/1023.0 volts.

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