Chapter 24

STIMUNO: Healthy and Synthesated Stimulation Tool Based TENS (Transcutaneous Electrical Nerve Stimulation) Using Boost Converter Microswitching ATTINY 13A for Paska Stroke

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Abstract

National geographic.co.id., 2014 shows that one of the main causes of death in Indonesia is stroke. Stroke is a disorder of brain function due to blood flow to the brain disorders (reduced). Weakening of the function of the brain causes problems with motor sensors in the muscles and causes paralysis of certain organs, loss of body balance, weakened muscle strength, decreased soft tissue flexibility, as well as impaired motor and sensory control. Thus, to reduce the number of deaths caused by stroke, it needs a solution on a regular basis. Generally therapy is done with treadmill, gymnastics, and cycling. However, the method has not been able to solve the problem. Thus, the authors created a device called STIMUNO: a TCT-based transcutaneous electrical nerve stimulation tool using ATTINY13A microswitching boost converter for post-stroke patients. STIMUNO works by stimulating electrically with TENS method on human skin tissue. The hardware works with the help of an intelligent microcontroller ATTINY13A system that controls the voltage to then be used as a medium for stimulation of muscles and nerves. The device consists of interconnected circuit and communicates with source voltage of 3 volts DC. The output voltage used to stimulate muscles and nerves is 72 volts 120 mA. In addition to simpler ease of maintenance hardware, STIMUNO can be developed continuously to meet the needs of patients because it has a very high flexibility to follow the needs of stroke patients in undergoing treatment. Where such provisions shall be in accordance with the rules of the competent medical personnel.

Keywords: Stroke, STIMUNO, TENS

Introduction

Stroke is a mental illness after heart and cancer. In ASEAN countries, stroke is a health problem that causes death. Based on data from the Southeast Asia Medical Information Center (SEAMIC) mentioned that major stroke mortality occurred in Indonesia, then Philippines, Singapore, Brunei, Malaysia and Thailand. Stroke mortality rate continues to increase with time, the higher the time a person the higher the possibility of stroke (Foundation Stroke Indonesia, 2012). Based on data from the Agency for Health Research and Development (2013) in 2007, the number of stroke patients was 8.3% and in 2013 increased to 12.1%. WHO predicts deaths from stroke will increase along with deaths from heart disease and cancer of approximately 6 million in 2010 to 8 million in 2030 (American Heart Association, 2010). Basic Health Research Data (Rikesda) in 2013 found stroke

prevalence in Indonesia of 12.1 per 1000 population. That number rose by 8.3% compared to Rikesda in 2007.

Based on data from Research Agency The increase of stroke patients in Indonesia caused lifestyle changes such as diet and lack of activity, genetic, diabetes, etc. Currently, stroke handling has been done with the therapy
treadmill, gymnastics and cycling. But healing with therapeutic therapy is not yet effective and efficient in curing stroke patients. So it needs a new innovation about alternative solutions stroke therapy patients more effective again. Therefore, the authors create STIMUNO: Healthy and Synthesated Stimulation Tool Based TENS (Transcutaneous Electrical Nerve Stimulation) Using Boost Converter Microswitching ATTINY 13A for Post Stroke.

Content

Weak muscle tissue that occurs in post-stroke patients is caused by symptoms of hemiparesis and hemiplegia. This causes paralysis that occurs in post-stroke patients. Method of return of physical function can be overcome with various kinds of treatment one of them is physiotherapist. Physiotherapist itself is usually done on post-stroke patients with a certain time according to the needs and level of paralysis experienced by the patient.

As the technology progresses piecemeal physiotherapy method can be done with electric concept based on TENS (transcutaneous electrical nerve stimulation). Physiotherapy aids work by stimulating muscle and nerve tissue by passing a voltage with a certain value through the skin surface of the patient.

But the hardware with the concept of integrastif equipped with TENS system used is relatively expensive, so the stroke treatment is still conventional as it is today by bringing physiotherapist medical personnel within a certain period. Therefore, STIMUNO is packaged as a tension-based muscle and nerve stimulation tool (TCT) using ATTINY13A microswitching boost converter for post-stroke patients. The hardware works with the help of an intelligent microcontroller system ATTINY13A which is enabled in controlling the voltage. The output voltage is a high voltage that has been through the boost converter process which is then connected electrode. The electrodes are divided into two parts that are cathode and anode. The device is applied to the stroke patient's arm for later use as a stimulant medium for the muscles and nerves.

Fig 1. Stimuno in patient's arm

Fig 2. Stimuno

The device consists of interconnected circuit and communicates with source voltage of 3 volts DC. The resulting output voltage is a high voltage that is set on a pulse width modulation (PWM) basis. The output voltage used to stimulate muscles and nerves is 72 volts 120 mA. The output voltage output is strongly influenced by PWM, and solenoid. PWM serves to perform microswitching on DC currents that have been stored on the solenoid. The output can be seen from the following test table:

No	Solenoida (mH)	Tegangan Sumber (volt)	PWM	Tegangan output (volt)
1	100	3	30	60,7
2	100	3	35	65,8
3	100	3	40	69,9
4	100	3	45	73,3
5	100	3	50	74,8

From the above table it can be concluded that the output voltage generated by STIMUNO is greatly influenced by the configuration and configuration of the PWM pin on the microcontroller. The higher the PWM value will affect the greater the output voltage that can be produced. Then it can be said that pulse width modulation with a certain value will result in increasing the value of voltage that is delivered on the electrode.

Fig 3. PWM and Output Voltage

The voltage required to produce a TENS system is a range between 60-80 volts. STIMUNO has qualified as a medium for nerve and muscle stimulation. STIMUNO works by stimulating electrically with TENS method on human skin tissue. STIMUNO has a very small mechanical size. Circuit STIMUNO measuring only 1.5 cm x 3 cm.

Mechanical size complete with the overall size and two batteries as the main source, STIMUNO has dimensions of 4 cm x 3 cm x 2 cm.

Conclusion

In addition to simpler ease of maintenance hardware, STIMUNO can be developed continuously to meet the needs of patients because it has a very high flexibility to follow the needs of stroke patients in undergoing treatment. Where the provisions must be according to the rules of the authorized medical personnel. Then technically change the PWM configuration to change the value of the required output voltage.

From the description described earlier, it can be concluded that how to make muscle and nerve stimulation tool with STIMUNO can be arranged on microcontroller by using programming language C to adjust the pulse width with PWM technique. Using a source voltage of 3 volts DC and 100 mH solenoid can produce a maximum voltage of 75 volts that can be used as a medium of nerve and muscle stimulation in patients post stroke.

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