

Pulse Stimulator for Paralysed Limb

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ABSTRACT

A prototype model of a pulse generator is proposed to be designed and constructed. It is expected to assist the paralysed people of our society. This paper proposes a model that is cost effective and compact. The stimulator is designed to deliver the pulses at a faster rate so that the paralysed people can also overcome their disability and sustain as equivalent as others in the society. The proposed algorithm uses a controller to deliver controllable deterministic pulses through the electrodes. System proves to be efficient for paralysed people.

KEY WORDS: Pulse Stimulator, Paralysed.

1. INTRODUCTION

The development of electronics in the medical field has provided a great relief and support to the physicians all over to administer their treatment more successfully and easily. Further the latest trends in electronics have contributed a lot to the medical society to meet their requirements. More research is being done now a days to make the treatment more effective and also reduce the time and cost for the patients. Paralysis is a state which often leaves the affected person feel away from home due to the non-functioning of the affected part thus making him shun away from others. The curing of paralysis is done by a physiotherapist. By using various methods that take a long time and also invoices a huge cost. In the end some patients are completely cured, some partially cured and some with no improvement in their condition. This problem makes people to fear loss of time and money and they remain as such persisting with the paralysis. The basic idea proposed in this paper is to generate pulses using electronic circuitry and pass it through the de nerved nerves, which in turn shall enable the muscular movements. This movement is very much required in order to make a particular action of the body. This pulse acts in a similar way to the pulse from the brain except that this is being given from external source. The muscle movement helps us to achieve the objective as said earlier. Doctors all around the world still face the challenge of complete curing of the paralysis. Broadly classified there are two types of paralysis namely, Complete Paralysis, and Partial Paralysis.

Electrotherapy: Electrotherapy employing for a low voltage impulse currents has become an accepted practice in the physiotherapy department.

- It makes the use of variable rate multi vibrator (M1) to set basic stimulus frequency.
- The output from the free running multi vibrator triggers the mono stable (M2) circuit, which sets the pulses
- The output provides an interrupted galvanic output whose rate as well as duration can be controlled.
- Another a stable multi vibrator produces short duration pulses called faradic currents
- Faradic currents are modulated at a frequency set by multi vibrator M1 in a mixer circuit (M4).
- The output of M4 is surged faradic current.
- By integration of output of M2 the interrupted galvanic pulses can be modified to have an exponential rise and fall. The shape of these pulse is similar to triangular waveform.
- Finally any one of the waveform can be selected through a selector switch and fed either to an emitter follower stage in order to provide a low impedance constant voltage or a high impedance constant current.

2. MATERIALS AND METHODS

The block diagram of the proposed system is shown in the below figure. The opto emitter (source) and the phototransistor (detector) together form the sensor. The role of opto coupler is to avoid any damage to the system due to voltage transients, spikes, or surge. The back emf from the stepper motor is essentially avoided with the help of MCT2E Optcoupler.

The driver board may be viewed as two segments namely the pre driver and the power driver. The optocoupler output is received by the pre driver which uses BC107 transistor for current amplification. The power driver unit utilizes TIP122 transistor for the purpose of amplification. Then the amplified signals/ impulses are delivered to the target by means of silver electrodes. Silver electrodes are used for this purpose because their potential variation due to artifacts is very less and meet the standards of performance. This system uses a embedded controller that has built in ADC, RAM, ROM, ports, USART, DAC, thereby reducing the size of the circuitry. PIC 16F877A microcontroller is used in this system in coordination with Power supply, oscillators and other interfaces to achieve the specified task.

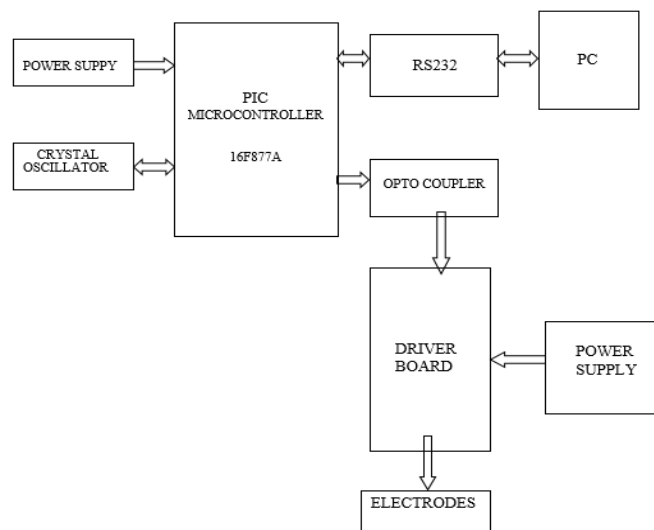


Figure.1. Block diagram of the proposed system

3. RESULTS AND DISCUSSION

By the pulse generator kit two types of pulses are produced, namely RAMP and SQUARE pulses. When applied to a paralysed person, the RAMP pulse produced less and SQUARE pulse produced intense reactions. From this result we concluded that RAMP and SQUARE pulses should be used based on the severity of paralysis. For starting stage, RAMP pulses are enough and for acute paralysis SQUARE pulses are more effective.

4. CONCLUSION

In future this system can be modified as an orthosis for wearing on a body part of a person; A sensor can also be used on the orthosis for detecting the movement of the body part. If movement of the body part is detected producing a sensor signal, the controller comparing the sensor signal to a threshold value and if the sensor signal exceeds the threshold value generating an electrical output from the electrode to the muscle so as to stimulate movement of the body part in a way indicated by the movement. Implant electrodes can also be used in future for spinal cord injured person. This system needs to be surgically implanted into muscle groups and are aimed at control of deep muscles.

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