

Implementation of a system that emulates the generation of action potentials and synapses.

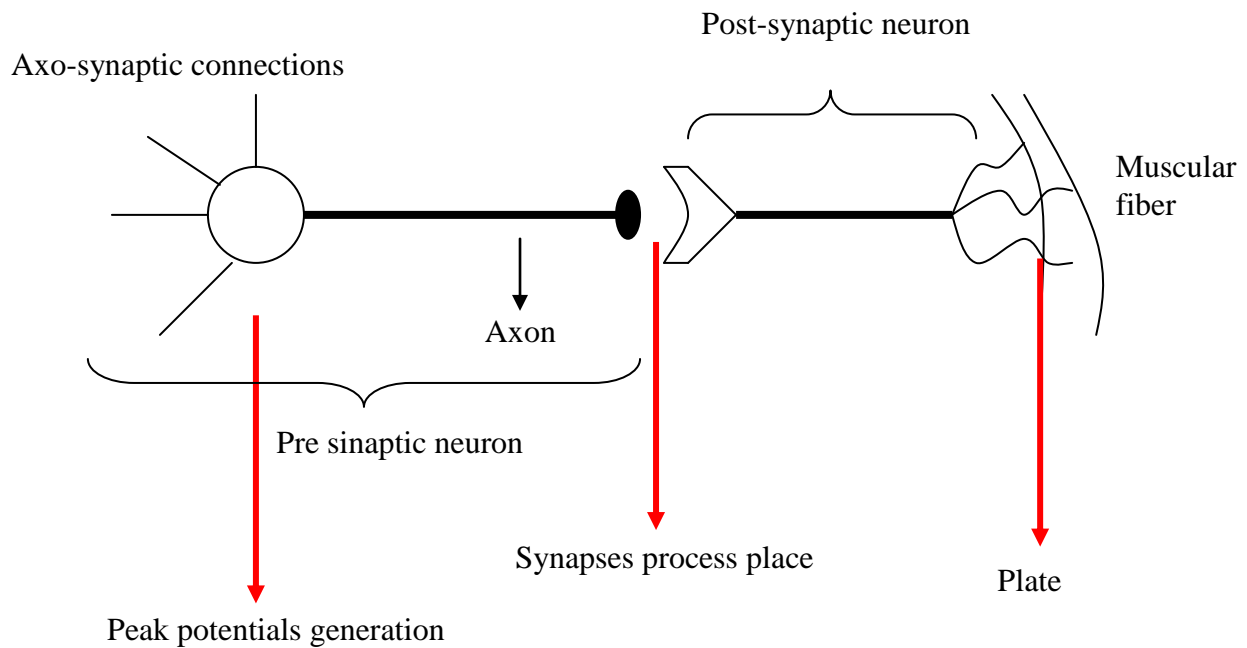


Figure 1. Basic diagram of the system to implement.

1, Objectives.

- To give a physical model, emulator of the operation of a neuron and all the associate structures that allow the movement of muscles. The system must be versatile enough to allow demonstrative session for teaching purposes.
- The system must be provided with a mechanism that allows the configuration of time scales operation, so a very close to the real counterpart emulation can be accomplished

2. Aspects that will be considered in the implementation

- i. Generation of action potentials.

For action the action potentials generation, the following details will be considered.

- Operation "all or nothing or nothing" when the level of action potential is reached Hiper-polarization and Re-polarization of the membrane of the neuron
- Four axo-somatic, configurable connections. Each connection can be configured in separated way.

- Automatic stabilization of the membrane after an action potential event.
- Immunity to the axo-somatic stimulus while being in period of action potential
 - ii. For the synapse process.
- Visible manifestation of the liberation of the neurotransmitter in "the demonstrative" mode (for academic aims).
- Visible electrical manifestation in the oscilloscope of the process "all or nothing"
- Manifestation of the relation between the speed of movement and the frequency in the excitation peaks

3. Schematic of the model.

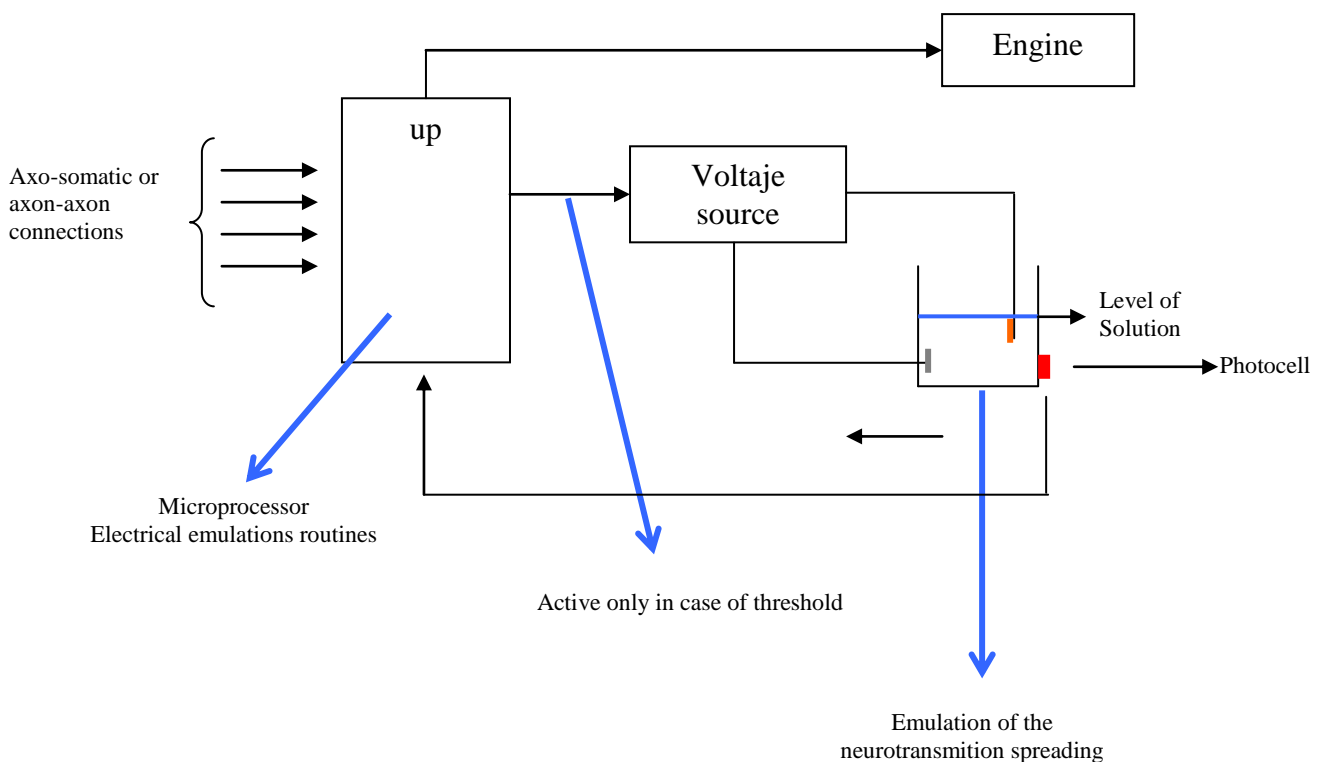


Fig 2 General idea of the solution.

Generation of action potentials.

The microprocessor has four entrances to simulate axo-somatic connections. Each connection could be of inhibiting nature or exciting nature. The nature of the

connection could be defined through a hardware device. Each one of the connections has an associated switch that generates a change of state in the respective entrance of the up. According to the nature of the stimulus, each pulsation will generate an addition or a subtraction in a register. When the register reaches a pre-established value (threshold level), the action potential will be generated, in which case, the same register is loaded with its maximum value or peak level. Then a regressive account will begin on the value of the register and more stimuli will not be accepted until the register has a value smaller or equal to the threshold level.

The maximum frequency of generation of action potentials is defined by the time that takes the regressive account in taking the register from the maximum level to the threshold level.

After a peak potential appears, the system won't receive more stimuli until the register has a value equal or lower than the threshold level.

The appearance of an action potential will cause that a logical one is generated in the exit towards the power interface.

Process of Synapse.

There is a connection between the microprocessor and the voltage source. Whenever an action potential is generated, the voltage source will be on setting a voltage of 1.5 Volts into the solution (water + Brilliant blue crysol) . If the action potentials appear in the maximum frequency, the voltage average in the plates will be 1 Volt, which will induce the change of color in the solution, turning it into blue. If the action potentials do not appear to the maximum frequency, the water will continue acquiring a blue fashion but clearer. The changes of colours in the solution are caught by the photocell, whose signal is sent again to the microprocessor.

Motor Action.

The photocell gives its analogous signal to the microprocessor, where an analog to digital conversion process begins. Once the action potential appears, the functions of conversion AD are activated. The system will read the photocell entrance twice between each potential peak (theorem of the sampling of Nyquist). The system will make a comparison between a reading and another one, to determine the cup of change and according to this cup of change, will feed the pulse width modulation (pwm) module.

The pwm module acts in the connected motor trough a power interface. The work cylce of the pwm will be proportional to the cup of change between the two readings of the A/D converter.