

## **A New Approach towards Intelligent Single Neuron Architecture**

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**Abstract:** *In modern day communication semiconductor technology has created a revolution both in performance and portability of a system. Years of studies on biological system indicates that the surface of the human brain has been scratched in its technology, and implementing the artificial brain could make wonders in computing world that has never been imagined. Since brain is complex structure it is evident and convenient to begin with the basic building blocks. This paper presents a new approach towards synthesizable VHDL implementation of a single neuron model in VLSI.*

**Keywords:** *Technology, portability, brain, synthesize, neuron*

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### **I. Introduction**

In recent Years advancements in technology has grown widely. With the development in semiconductor IC this technology scientists are able to build new electronic items which are more superior and accurate and well in their performance. But with the growth in the demand for new technology has raised questions of more and more compact size as well better performance with reduced power consumption. Technology like SOC application specific Integrated circuits are developed to compromise the requirement but the problem is human beings are constant learning machines, they learn and quickly adopt and gets synchronized with the speed and techniques of the design. And so technology becomes old day by day after invention of the technology. In recent studies on the human brain has discovered that neurons [1] are some kind of elementary units in communication inside Human brain. So now it is easy to question our self's that Does biological imitation could be a solution of every problems in the real world environment? The paper however will not give the exact answer but way to approach to the conclusion could be reasonable for an intelligence person.

Biological system like human body has a separate way of communication with its peripherals and surrounding perhaps it could be very difficult build on human body but on the other hand it may not be fantasy to assume it. Some parts of the human body can be made not biologically but with some artificial substances which could look the same and function as same. Here the real important part to understand is that they function like human parts but essentially as we cannot understand the exact communication in human body and so they are not properly synchronized. Eventually synchronization may not guaranty any perfect result but definitely better result than before. For an instance this paper is going to take only neuron in to consideration and would imitate its operation and function. Considering the operation of neuron, signals are transmitted from one place to the other separated by even large distances these neurons utilize multilayered structured to pass information over large distances. Every day many neuron die and many will regenerate and the process repeats and repeats. A neuron is in a three dimensional space like planets in our universe. As every planet has different sizes and names so as the neurons do. As there are different neurons as well different sections in a human brain it would be more realistic to theorize that a bio-electric signal must and should have an identity of its own just for a neuron to recognize its origin and destiny and which path to travel.

### **II. Action Potential**

The Biological systems utilize energy to do work, mean while energy conservation also has some effect on metabolism in the biological system. Every living system converts food into energy. This energy is utilized by the body to do work. Action potentials are generated by special types of voltage-gated ion channels embedded in a cell's plasma membrane. These channels are shut when the membrane potential is near the resting potential [2] of the cell, but they rapidly begin to open if the membrane potential increases to a precisely defined threshold value. When the channels open, they allow an inward flow of sodium ions, which changes the electrochemical gradient, which in turn produces a further rise in the membrane potential. This then causes more channels to open, producing a greater electric current across the cell membrane, and so on. The process proceeds explosively until all of the available ion channels are open, resulting in a large upswing in the membrane potential.

### III. Proposed Theory

In the proposed theory naturally dendrites are inputs from the surrounding neurons and the axon is used to broadcast the signal to all other neuron surrounding it. In practice it is not advisable to imagine that all signals enters dendrites at once to imagine an adder in the first stage of reception. Instead imagine neurons are scattered in certain area as the stars in the galaxy. So the question is which star information is likely to be processed? The answer is dependent on the user i.e the neuron itself and so neuron itself is a kind of an intelligent system in its 3D space surrounded by its kind. So the figure 1 shows a more realistic model of neuron where equality condition would switch the neuron in off state and unequal condition will trigger the logic Processing Unit (LPU). The LPU however performs the logical operation and broadcast the signal through axon. The firing logic is tabulated in the table -1. This means that neurons are like switches. The 2D-array of such neurons forms a network of logical switches. However the brain is a 3D object full of different section with every section consisting of large number of layers and so there would be a possibility of change in communication from layer to layer. However this paper is proposed to single layer neuron surrounded by 2D array of neurons.

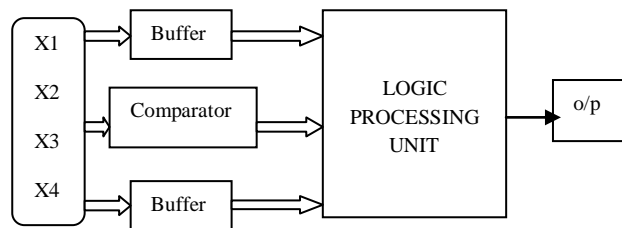


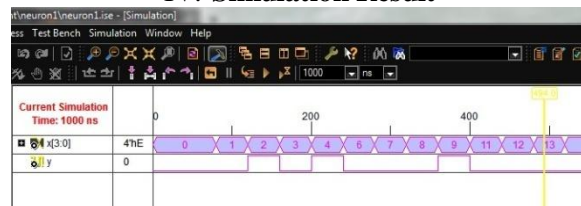
Fig. 1 Single neuron building blocks

The below combinations are avoided for processing since it becomes very complicated to process equal signal by this simple architecture.

Table.1 Avoided states from switching a neuron to off state

Inputs				Comparator	O/P
x3	x2	x1	x0	o/p	
0	0	0	0	A=B	Switch off
0	1	0	1		Switch off
1	0	1	0		Switch off
1	1	1	1		Switch off

### IV. Simulation Result



### V. Conclusion

Thus we have successfully synthesized and simulated the new approach towards a neuron which itself has a capability to of making decision itself which signal to process to the neural network and which signal to stop to the network. This could be a contribution to design an intelligent node in the network.

### References

**Books:**

- [1]. Artificial Neural Network: An Introduction ( Kelvin L.Pridy and Paul E.Keller -2005)
- [2]. Biomedical Instrumentation and Measurements ( Leslie Cromwell, Fred J. Weibell, Erich A. Pfeiffer-2011)