



Artificial Neural Network

Definition

In English, *Artificial Neural Network*

In the field of electronics, the network referred to as "neural" is a model that reproduces the behavior of the human brain. In other words, it is an "intelligent" system which is made up of "neurons" and evolves according to its environment and its experiences.

The neurons broaden their knowledge as a result of their **experiences** and the **exchange** that takes place between them.

Principle: A network of "intelligent" nodes.

The artificial neural network is characterized by:

- a set of artificial neurons: nodes;
- the interoperability of the system: the neurons communicate with each other;
- programming rendered possible thanks to algorithms.

The diagram below elaborates the principle of an artificial neural network:

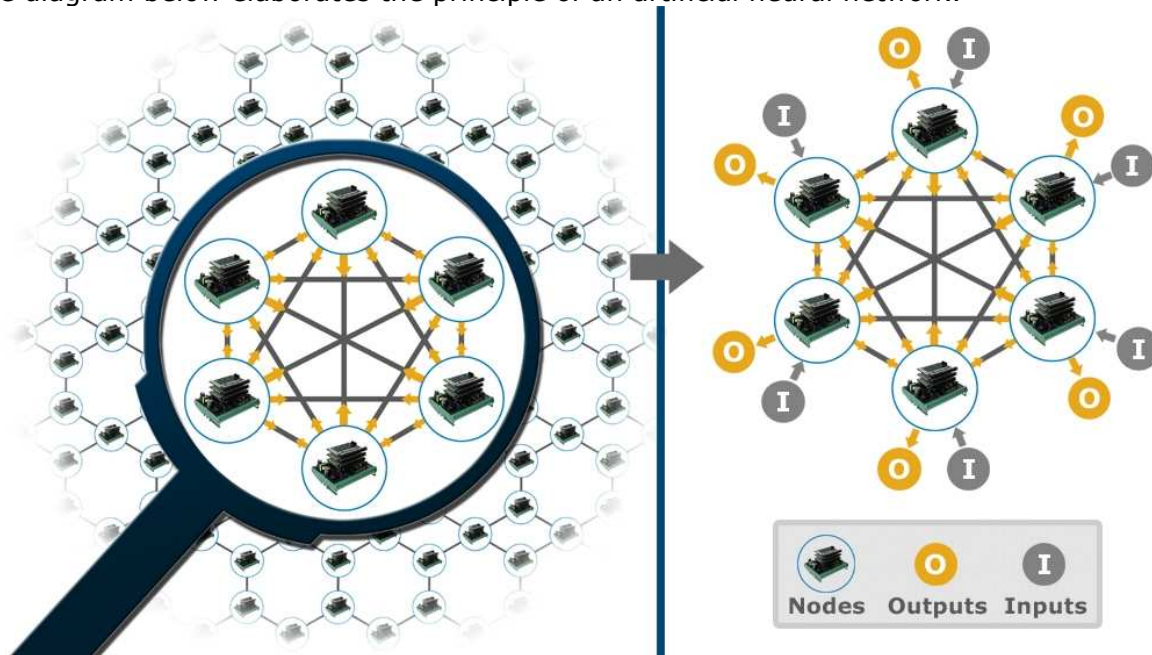


Diagram 1: neural network

The input and output data builds the **rules of behavior: the algorithms**.

The algorithm depends on the frequency of the behavior and is therefore a determining factor for the output.

The output corresponds to the processing that the network is subjected to as a result of a learning phase. The outputs can be:

- **binary** (1 or 0), which means they can have only two options (1 = presence of the object or 0 = absence of the object);
- **analogical**, which means they can have variable options.

A technology based on an artificial neural network

The system of WIRECOM Technologies is based on a neural network. This is a **technology of distributed architecture** that is decentralized.

Utilizing the concept of the neural network, the nodes are made of integrated circuit cards which transfer information through low speed Power Line Communication. Each node is placed on the network in such a way as to regulate in an optimum manner the demand of energy. The algorithms of regulation favor the optimization of energy.

There are two kinds of inputs and outputs:

- All or Nothing option : switch, contactor, button, etc. ;
- analogical (variable levels).

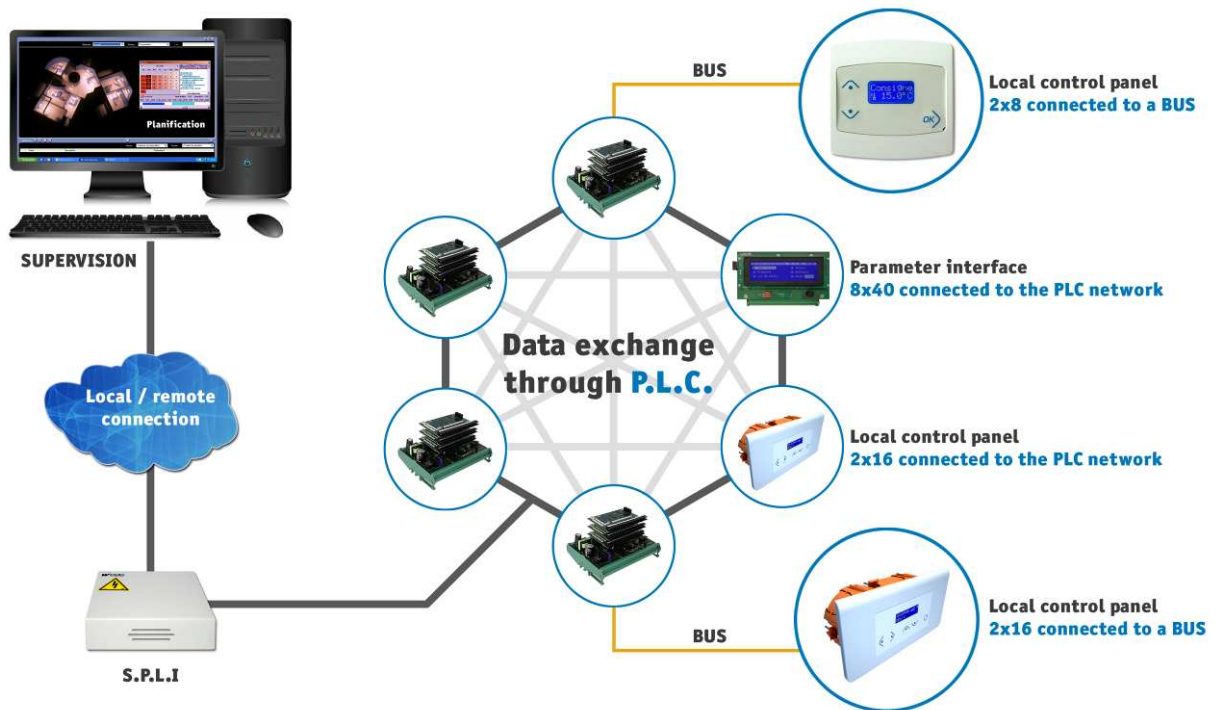


Diagram 2: The neural network applied to the WIRECOM Technologies system

The diagram shows that here we have a supervised learning paradigm. In other words, the initial algorithm is fixed and the network sorts out the necessary adjustments in order to regulate the energy.

Advantages

The neural network enables:

- rapid learning thanks to algorithmic calculations;
- processing of non-linear behavior (distributed intelligence);
- autonomy of neurons;
- interconnection between a large number of nodes;
- few steps in processing;
- a tolerant approach towards errors.

The WIRECOM Technologies system and the neural network

The founders of the company have selected the neural network in order to benefit from the cited advantages.

Moreover, this is a technology which is efficient in numerous applications, mainly for the regulation of energy. It enables:

- a permanent **exchange** between the nodes;
- **autonomy** of the nodes, referred to as floating;
- a **high performance** level to predict behavior and optimize the algorithm of regulation;
- a **rapid response** to the demand of energy;
- **optimization of low speed transmission** : action of the nodes in receiving data;
- **breakdown without repercussions**: if one node fails, it does not create a malfunctioning of the other nodes; the other nodes inform the supervisor.

Its performance depends on:

- the amount of data exchanged between the nodes;
- the intelligence within each node.

These conditions are necessary for a smooth adjustment of energy consumption.

Neural network and other technologies

Besides the neural network, the WIRECOM Technologies system uses other technologies, which give it the necessary efficiency to control the demand of energy: the low speed PLC and the LonTalk Protocol.

The data is transported in low frequency on the electrical network through low speed power line communication (PLC). The low speed PLC, a technology standardized since 1989, enables the WIRECOM Technologies system to actually be **Plug & Play**. It uses the universal electrical network currently existent in all buildings in order to transfer information between the nodes. **LonTalk, the protocol of transmission of electronic data offers the best link between data/speed.** The nodes consist of a microprocessor which utilizes the recorded data with extreme precision.

The union of these three technologies is the key to the performance of the WIRECOM Technologies system!