

Biosensors and L-sensors

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Entering the 21st century, Information technology (IT) has speeded up researches in many fields and this may be the main reason that research in the field of sensor networks has enormously increased over the recent years.

Biosensor network is a kind of sensor networks consists of a number of biosensor nodes having the capability of communicating with each other usually in an ad hoc network.

A biosensor is an analytical device which usually converts a biological response into an electrical signal. The term 'biosensor' is often used to cover sensor devices to determine the concentration of substances and other parameters of biological interest even where they do not utilize a biological system directly. This is an example of a biosensor for the detection of glucose in whole blood or in food. It is said that the father of biosensor or biosensor concept is Prof. LD Clark who developed the first biosensor in 1962, where an ampero metric oxygen electrode was immobilized with an enzyme (glucose oxidize).

It is well known that the main challenges in front of sensor networks are: decreasing power consumption, increasing processing power, preserving the confidentiality and the portability.

Today, the combination of the knowledge in electrophysiology, neuroscience, bioelectronics, solid-state, integrated circuit and information technology may offers the possibility of a new generation of highly specific, low power consumption, intelligent, sensitive, selective and reliable sensor networks that we call L-sensor networks.

With the L-sensor we mean a living sensor like a neuron. Suppose a portable device capable of recording the action potential activity from a network of mammalian neurons grown on glass microelectrode arrays. Changes in the action potential firing rate across the network are monitored to determine exposure to toxicants.

The human body is constructed from cells. Each cell has a membrane, and there is a potential difference between the two sides of the membrane, so every thing that affects the membrane can change the potential of it, i.e. cell acts as an L-sensor of that thing. In other

words human body is the sensor of almost every thing like temperature, acceleration, force, pressure, radiation and so on. In other words we may treat human body as a portable, low power consumption and reliable L-sensor, and a group of people may be looked as an L-sensor network.

Dream up a day, you sit on the seat of your car, fasten your belt and start driving, the seat and the belt have connections to your body as well as the computer of your car; the computer processes received bio-signals from your body and computes: the acceleration and speed of your car, the ambient temperature, air pollution, the traffic in the street where you are driving and so on. Here your body acts as an L-sensor nod and the data from it is processed and collected by the computer. The data from your and others' car computer may be sent to a central station via a wireless network and be used to measure the mean air temperature, air pollution and the traffic.

Regarding today's knowledge and technology, using human body as a portable, power less, and reliable L-sensor isn't an imaginary and unreasonable idea.

Using human body as a commercial L-sensor or using a set of human bodies as a L-sensor network, is an innovative hypothesis that faces many challenges, for example if we believe that one's body can act as a velocity sensor, i.e. if some signals on the surface of his or her body contain information about the velocity and if at the same time his or her body acts as a pressure sensor, then how can we separate these signals? I.e. the bio-potentials that are recorded on the surface of the body are combinations of many propagated potentials, then the extraction of desired signal needs innovative signal processing algorithms and tools.

Our experiences in the research laboratory of signals and sensors at the Iran University of Science and Technology (IUST) show that the installation of electrodes in the proper location of body is a key aid for sensing correctly the desired quantity like acceleration.

Although L-sensor and L-sensor networks are at the beginning of a long research way, we are sure that the global cooperation of scientists makes this path short.

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