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A BRIEF OVERVIEW OF E-NOSE

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ABSTRACT

An E-nose is a electronic device . Which is identifies the specific components of an order and analyzes . Its chemical makeup to identify it . An electronics nose is generally composed of a chemical sensing system and a pattern recognition system. E-nose based on the biological model work in a similar manner albit substituting sensor for the receptors and transmitting the signal to a program for processing , rather than to the brain.

Keywords: Electronic Nose; Biosensor; Clinical Diagnosis.

I. INTRODUCTİON

An electronic nose is a electronic device that can be used to detect odours. "ELECTRONIC SENSING" technologyes have undergone important devlopment from a technical & commerical point of view . The expression "ELECTRONIC SENSING" refer to the capability of reproducing human senses using sensor arrays and pattern recognition techniques. The E-noise draws its motivation from biology.

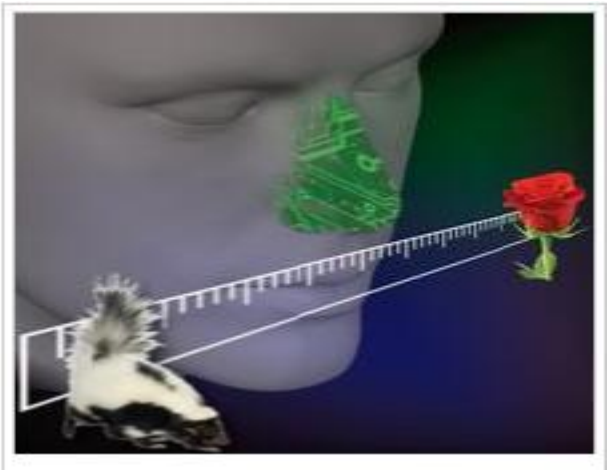

Fig.1 Human Nose

II. BIOLOGICAL OLFACTION SYSTEM

One of the incredible natural system is the mammalian olfactory system. A specialized tissue that can be presence in the nose called olfactory epithelium contains olfactory receptor cells. These nerue cells interaet with the odourant molecoles and cause the sensation of smell.The factory cell consist of number of the cilica , where G receptor binding protins are located at the surface of the cilica. These G receptor binding proteins cause excitation in the neurons. They have partially overlapping sensistivities

odourants and are about 100 million factory cells, which amplify the signal and generate seeondary message (Gardner 1994)- The sensory cells in the epithelium respond by transmitting signal along axon in the olfactory bulb, where it terminates in a cluster of neural network called glomeruli these signals are further prucssed in about 10000 mitral cells and then finally sent uia a granular cell layer to the brain (keller 1999). In the brain, the signals are decoded using a kind of pattern recognition[1]

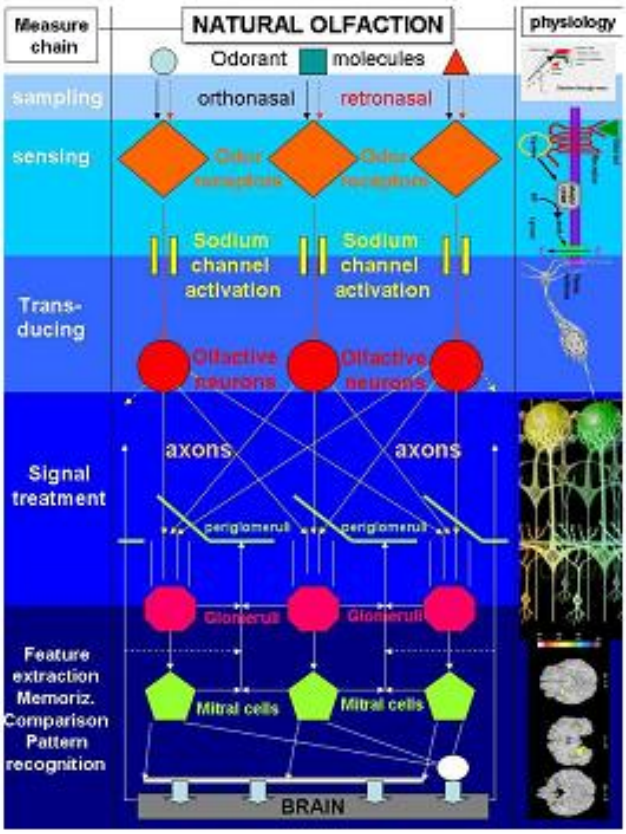

Fig.2 Flowchart of Natural Olfactory System

III. ELECTRONIC NOSE

Electronic nose system is an artificial olfactory system. In E-nose system , the factory receptor cell are replaced by a chemical sensors. The sensors generate a time dependent electrical signal in response to the interaction of an oclour with the sensor itself data preprocessing unit represent the olfactory bulb , which compensates for sensor drift and noise The final stage in artificial olfaction is the pattern recognition system , which can be work as human brain (Gardner 1999)[2]

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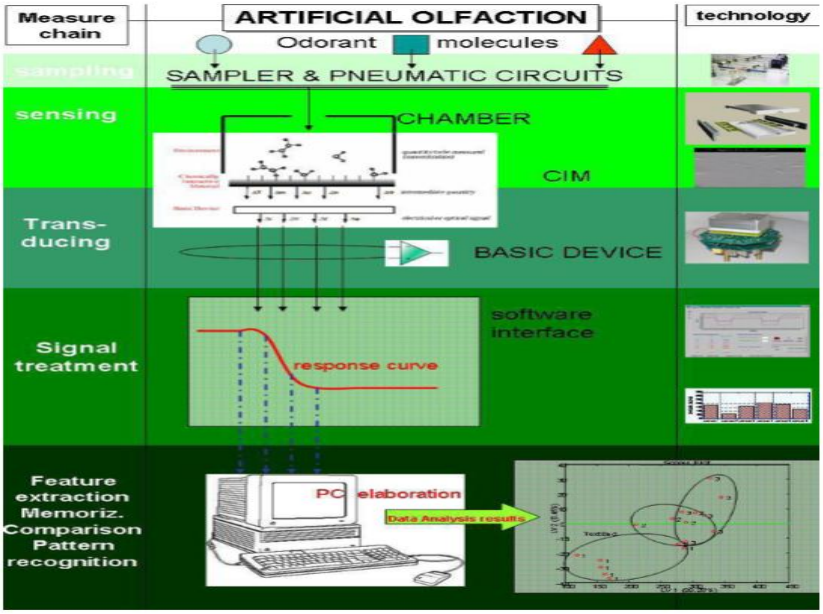

Fig.3 Artificial Olfaction System

IV. WORKING OF E-NOSE

Instrument of E-nose consist of head space sampling , chemical sensor array and pattern recognition modules , to generate signal pattern that are used for characterizing odors [3].

There are three major parts of –

(a)Sample delivery system –

The sample delivery system enables the generation of the volatile compounds of a sample , which is the fraction analyzed . The system then insets this headspace (volatile compounds) into the detection system of the E-nose.

(b)Detection system –

Detection system consist of a sensor set . It is the "reactive" part of the instrument then in contact with headspace , the sensor reaet ,which means they experties a chang of electrical properties .

The sensor technology of artificial olfaction had its beginnings with the invenion of the first gas multisensor arry in 1982 . Further aroma sensor technology, electrunics , biochemistry and artificial made it possible to develop devices comable of measuring and charactening volatile aromas relesed from a multitude of source for mang application .

(c)Computing system –

Computing system works to combine the response of all the sensors , which represents the input for the E-nose performs global finger print anglgis and provides results and representation.

V. SENSORS

The sensor array in an electronic nose performs very similar functions to the olfactory nerves in the human olfactory system. Thus, the sensor array ma y be considered the heart and most important component of the electronic nose. The instrument is completed by interfacing with the computer central processing unit (CPU),

recognition library and recognition software that serve as the brain to process input data from the sensor array for subsequent data analysis. he most widely used class of gas sensors are the metal-oxide gas sensors. Some common electronic-nose gas sensors and their machenism is given below:

Sensor type	Sensitive material	Detection principle
Acoustic sensors: Quartz crystal microbalance (QMB); surface & bulk acoustic wave (SAW, BAW)	organic or inorganic film layers	mass change (frequency shift)
Calorimetric; catalytic bead (CB)	pellistor	temperature or heat change (from chemical reactions)
Catalytic field-effect sensors (MOSFET)	catalytic metals	electric field change
Colorimetric sensors	organic dyes	color changes, absorbance
Conducting polymer sensors	modified conducting polymers	resistance change
Electrochemical sensors	solid or liquid electrolytes	current or voltage change
Fluorescence sensors	Fluorescence-sensitive detector	fluorescent-light emissions
Infrared sensors	IR-sensitive detector	Infrared-radiation absorption
Metal oxides semi-conducting (MOS, Taguchi)	doped semi-conducting metal oxides (SnO2, GaO)	resistance change
Optical sensors	photodiode, light-sensitive	light modulation, optical changes

Commonely used electronic-nose sensor and their advange and disadvatage is given below:-

Sensor type	Advantages	Disadvantages
Calorimetric or catalytic bead (CB)	Fast response and recovery time, high specificity for oxidized compounds	High temperature operation, only sensitive to oxygen-containing compounds
Catalytic field-effect sensors (MOSFET)	Small sensor size, inexpensive operating costs	Requires environmental control, baseline drift, low sensitivity to ammonia and carbon dioxide
Conducting polymer sensors	Ambient temperature operation, sensitive to many VOCs, short response time, diverse sensor coatings, inexpensive, resistance to sensor poisoning	Sensitive to humidity and temperature, sensors can be overloaded by certain analytes, sensor life is limited
Electrochemical sensors (EC)	Ambient temperature operation, low power consumption, very sensitive to diverse VOCs	Bulky size, limited sensitivity to simple or low mol. wt. gases
Metal oxides semi-conducting (MOS)	Very high sensitivity, limited sensing range, rapid response and recovery times for low mol. wt. compounds (not high)	High temperature operation, high power consumption, sulfur & weak acid poisoning, limited sensor coatings, sensitive to humidity, poor precision
Optical sensors	Very high sensitivity, capable of identifications of individual compounds in mixtures, multi-parameter detection capabilities	Complex sensor-array systems, more expensive to operate, low portability due to delicate optics and electrical components
Quartz crystal microbalance (QMB)	Good precision, diverse range of sensor coatings, high sensitivity	Complex circuitry, poor signal-to-noise ratio, sensitive to humidity and temperature
Surface acoustic wave (SAW)	High sensitivity, good response time, diverse sensor coatings, small, inexpensive, sensitive to virtually all gases	Complex circuitry, temperature sensitive, specificity to analyte groups affected by polymeric- film sensor coating

VI. APPLICATION

Electronic nose instruments are used by research and development laboratories, quality control laboratories and process & production departments for various purposes:

(A) In quality control laboratories for at line quality control such as

1. Conformity of raw materials,
2. intermediate and final products,
3. Batch to batch consistency,
4. Detection of contamination,
5. spoilage, adulteration Origin or vendor selection,
6. Monitoring of storage conditions.

(B) In process and production departments

Managing raw material variability Comparison with a reference product Measurement and comparison of the effects of manufacturing process on products Following-up cleaning in place process efficiency Scale-up monitoring Cleaning in place monitoring.[4]

VII. CONCLUSION

In this paper we discussed electronic noses , a prototype system that identifies common house - hold chemicals, and applications of electronic noses in the environmental, medical, and food industries. The major differences between elec- tronic noses and standard analytical chemistry equipment are that electronic noses (1) produce a qualitative output, (2) can often be easier to automate, and (3) can be used in real-time anal- ysis.[2]

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