WHAT IS E-NOSE?

Electronic noses are engineered to mimic the mammalian olfactory system.
An electronic nose (e-nose) is a device that identifies the specific components of an odor and analyzes its chemical makeup to identify it.
• Volatile organic compounds (VOC) are basic to odours.

• The human nose is not sensitive to all kind of VOC’s.

• It is also important to have a detection system for VOC’s which are hazardous to human beings.
Many facts lead to the requirement of an electronic detection system for odours which is “Electronic Nose”
Can be regarded as a **modular system** comprising a set of active materials which detect the odour, associated sensors which transduce the chemical quantity into electrical signals, followed by appropriate signal conditioning and processing to **classify known** odours or **identify unknown** odours.
WHAT DOES E-NOSE CAN DO?
• E-nose can be sent to detect toxic and otherwise hazardous situations that humans may wish to avoid.

• Human olfactory system may be unstable with respect to mood or physical condition, but E-nose are not.

• Accurate decision making capabilities because of pattern matching technology.
• Instrument designed to allow repeatable identifications and classifications of aroma mixtures.

• Determines the various characteristics properties of the odour while eliminating operator fatigue.
HOW ENOSE WORKS?
Device intended to detect odors or flavors.
BASIC DESIGN OF AN E-NOSE
The sensor’s response as electrical signals is recorded and delivered to the signal processing unit and is processed by using the signal processing unit, whose output is undergone a pattern recognition and comparison process that prompts decision making.
COMPARISON
COMPARING THE BIOLOGICAL NOSE TO THE E-NOSE
Each and every part of the electronic nose is similar to human nose.

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<th>Biological Nose</th>
<th>E-Nose</th>
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<td>Inhaling</td>
<td>Pump</td>
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<td>Mucus</td>
<td>Filter</td>
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<td>Olfactory epithelium</td>
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<td>Cell membrane depolarized</td>
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<td>Nerve impulses</td>
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Working principle of an e-nose
COMPONENTS OF E-NOSE:

- **Sample delivery system (Sample handling system),**
  - Generates the headspace of sample to be analyzed
  - Exposes the odorant to the sensors

- **Detection system (Sensing system),**
  - Array of different sensors
  - Each sensor has different sensitivity to different gases
  - Produces a pattern characteristic of the odour

- **Computing system (Signal processing & pattern recognition).**
Sample delivery system

- Enables the generation of the headspace (volatile compounds) of a sample.

- The system then injects this headspace into the detection system of the e-nose.
Detection system

• Consists of a sensor set, is the "reactive" part of the instrument.

• Adsorption of volatile compounds on the sensor surface causes a physical change of the sensor; they experience a change of electrical properties.

• A specific response is recorded by the electronic interface transforming the signal into a digital value.

• Recorded data are then computed based on statistical models.
Detection system

• Using array of sensors, each sensor designed to respond to a specific chemical

✓ Number of unique sensors must be at least as great as the number of chemicals being monitored

✓ Each element measures a different property of the sensed chemical

✓ Each chemical vapor presented to the sensor array produces a signature or pattern characteristic of the vapor
Computing system

- Works to combine the responses of all of the sensors.
• **Main sequential steps:**

- ✔ Pre-processing
- ✔ Feature extraction
- ✔ Classification
- ✔ Decision making
• **Pre-processing:**

- Compensates for sensor drift
- Compress the transient response of the sensor array
- Reduces sample to sample variations
• **Feature extraction:**

- Reduce the dimensionality of the measurement space
- Can be more readily inspected visually
- Extract information relevant for pattern recognition
- Performed with linear transformations
- Nonlinear transforms,
Classification:

- Bayesian classifiers, Artificial Neural Network (ANN) etc are used.
- Trained to identify the patterns that are representative of each odour.
- Identify the odorant by comparing it with trained ones.
 Decision Making:

✓ Used for application specific knowledge
✓ Can determine whether given belong to any one in database or not
• Data base of the expected odorant should be compiled
Advantages:

- Detection of poisonous gas is possible
- Can be done in real time for long periods
- Cheaper than Trained human sniffer
- Individuals vary, e-nose don’t
- Digital representation of odour is possible.
• **Limitations:**
  - Time delay between successive tests
  - Insensitivity to some species
  - According to application, e-nose has to be changed.
THANK YOU!