Sense by MEMS: Revolutionising Sensing Techniques using Microsystem Technology

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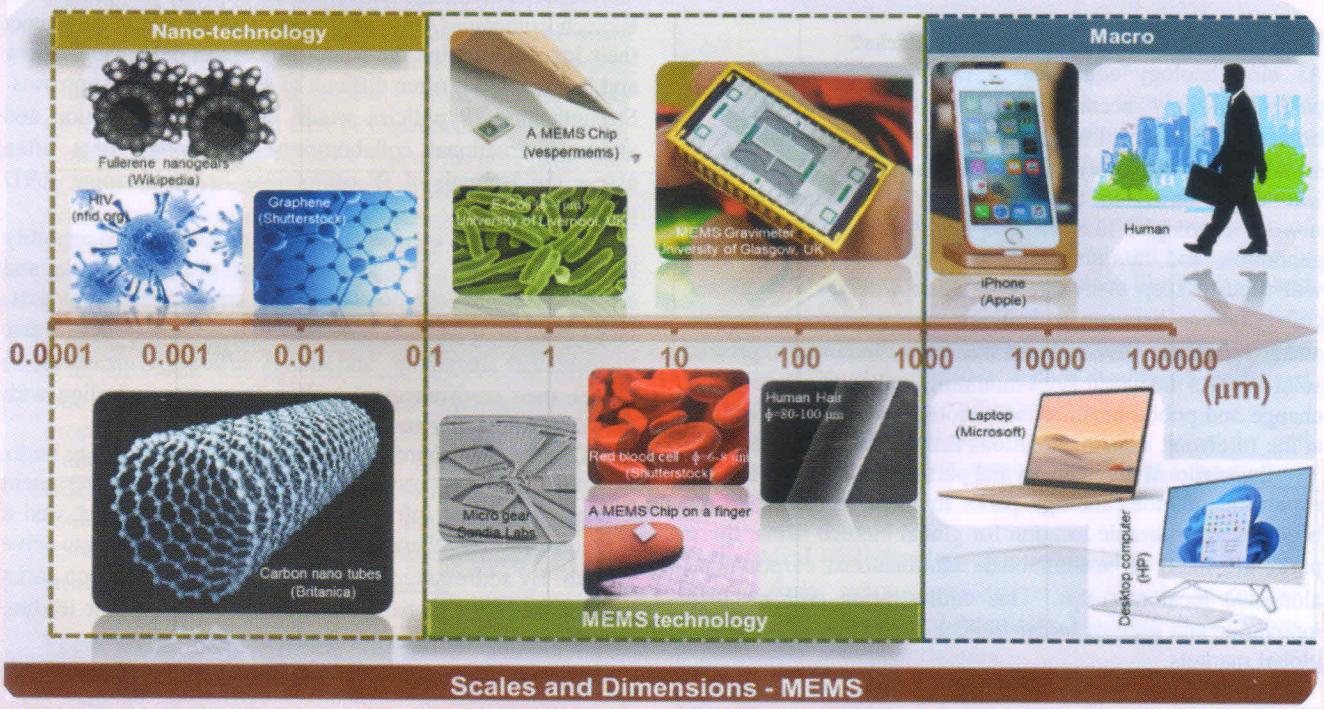
THE widespread impact of sensors in modern technologies is seen in many consumer and industrial applications, including smartphones, wearables, automotive systems, healthcare devices, and many more. One of the most adopted technologies to manufacture microsensors is Microelectromechanical Systems (MEMS) technology. It belongs to an extremely interdisciplinary branch of engineering and technology with an objective of miniaturisation of conventional sensors and actuators. Widely, it is familiar as a MEMS technology; however, in some parts of the globe, such as in Europe, it is also known as microsystem technology, and in Japan, it is also called micromachine technology. It deals with the fabrication of microsensors as well as microactuators with dedicated microelectronic circuits. The geometrical dimensions that are being realised using the MEMS technology are in the order of a few microns (μm) to 1000s of μm. These tiny dimensions can be visualised by a few examples, such as the diameter of human hair ranging from 80-100 μm, red blood cells diameter ranging from 6-8 μm and the average height of an Indian human being 1.65 m, and many others. Generally, the overall size of tiny MEMS sensing and actuating chips can be accommodated on our fingertips.

The MEMS technology-based devices have the capabilities to sense, actuate and control on a micro-scale and generate effects comparable to a macro scale. It consists of microsensors, microactuators, microstructures, and microelectronics. In general, the microstructures are the thin diaphragm, cantilever, suspended diaphragm, and comb structures which are treated as a primary sensing element. Moreover, microelectronics components are diffused piezoresistors, capacitors, inductors, and transistors integrated with the microstructures as secondary sensing for transduction of the physical input signal (i.e. pressure, temperature, acceleration, etc.) into an electrical output signal.

The MEMS technology is motivated by nature and can mimic many natural sensors with adequate accuracy. As human body has 5 sensory organs i.e. nose, ear, tongue, eye and skin. The nose can differentiate between fouling smell and fragrance, the eye can visually identify, the ear can hear sound and distinguish between noise and information, the tongue can



A schematic view for scales and dimensions of various technology ranging from 1 Å to 10 cm and more for a better visualisation. Carbon nano tubes, fullerene nano gears, HIV, Graphene are classified in a nanotechnology dimensions. However, *e-coli*, red blood cell, human hair and a few MEMS devices are depicted in the MEMS technology dimensions. The mobile phone, laptop, desktop computers and human being are classified in macro dimensions.