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Letter to the Editor

Novel Trends in Sensor Developments for Strategic Technologies in the Modern Era

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Advanced trends of sensor technology are the key components within machine applications. A life without sensors has become challenging to implement and converge new technologies successfully. A sensor is a device, which detects events or changes in its environment and shares the information with other connected electronic devices [1]. Sensors play a vital role in electronic devices, while the applications of sensors have been expanded along with the progress in science and technology. Sensors are widely applied in various industries, such as smartphones, automobiles, Internet of Things (IoT), medical, bio-medical, nuclear, defence, aviation, robotics, artificial intelligence, agriculture, environment monitoring, and deep-sea applications. Although conventional sensors are still in use, advanced trends in microelectronics are taking sensor-based technology to a new level. The functionality of ordinary sensors has expanded in many ways, and the sensors are becoming more and more intelligent, providing higher accuracy, flexibility and easy integration into distributed systems [2]. Thus upon the application, there are a wide variety of sensors depending on the technology and applications, including IoT sensors, pollution sensors, radio frequency identification (RFID) sensors, image sensors, optical sensors, biometric and biosensors, printed sensors, and micro-electromechanical system (MEMS) and nano-electromechanical system NEMS sensors [3]. Among emerging latest sensor technologies, quantum imaging and sensing are the most developed sensing techniques [4]. Numerous proposed schemes in quantum metrology promise to revolutionize imaging and related tasks surpassing conventional techniques in resolution or sensitivity, with potential applications in bio-imaging, physical and material science, and detection and ranging applications. These novel quantum techniques will arguably constitute the basis for the next sensor generation. In the present medical assessment techniques, detecting alterations in live human tissues during disease conditions has become challenging. Most importantly,

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existing expensive methods such as Dual-energy X-ray absorptiometry (DEXA) do not provide 100% valid results on bone mechanical properties. Hence, novel sensor mechanisms were developed to measure bone mechanical properties by minimizing harm and pain to the patient at an affordable cost. These sensors can be used in any *in vivo, ex vivo* or *in vitro* situations. These biomedical sensors are capable of analyzing and comparing the mechanical properties of anatomical structures, such as strength, hardness and toughness. Moreover, the application of chemical sensors in commercial aircraft is another breakthrough in scientific findings. Potential applications of chemical sensors in commercial aircraft range from air quality to system health monitoring and smart maintenance [5]. The use of MEMS and nanotechnologies in realizing such sensor functionalities is demonstrated by various research groups.

On the other hand, the development of novel optical biosensors for environmental analysis has gained enormous interest among scientific researchers [6]. Environmental pollution has now become a severe problem, which threatens the health of human beings. Traditional analytical methods have several drawbacks, such as the need for professional operators and complicated instruments. After millions of years of evolution, biomolecules can perform various functions efficiently and efficiently due to their unique structures, offering a viable alternative to traditional methods. These innovative sensor structures were designed to permit self-monitoring or self-calibration. The rapid progress of these sensor technologies allows the production of systems and components with a low cost-to-performance ratio. The potential in the field of digital signal processing involves new approaches for the improvement of sensor properties. Therefore, these advanced trending multi-sensor systems can significantly contribute to enhancing the quality and availability of information for strategic technologies in the modern era.

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