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Editorial

The Impact of Implantable Sensors in Medical Applications

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Editorial

The use of wireless sensor networks in implantable devices is growing very rapidly because of the increasing demand for healthcare information systems. The progress of medical technology based needs to meet the growing demand of real world applications. Therefore, there is a need to use the systems for self-monitoring where the patient and the sensor acts in the same way and detects changes. Currently, there is a considerable amount of research and development in the world in the area of implantable body area networks that has some advantages over other monitoring systems, which has emerged in the field of biocompatibility networks which is considered in the meantime as one of the important topics ongoing research. Some challenges in biomedical technology with emphasis on implantable sensors in healthcare applications have to be researched. Implantable sensors raise unique problems regarding the design and realization of device structures that fulfill the requirements for use in the human body.

There are some important applications of implantable sensors in some real world healthcare applications where ISs and biomedical systems are playing an important role such as; (i) Brain stimulator. (ii) Heart failure monitoring, (iii) Blood glucose level.

Implantable systems need to be small, lightweight and separated from the harsh places. These systems should also consume a little power to allow a long-term processing in order to allow for data transmission to and from the implanted devices. The Development of advanced implantable systems requires a great amount of expertise and knowledge in different disciplines such as materials, electronics, signal processing, chemistry, biology, physiology, etc.

Implantable sensors systems offer great advantages to increase the medical care and improve the quality of life style, consequently leading to substantial investment in biomedical systems. Biomedical sensors represent the main component in the medical diagnostic and monitoring systems and play an important role in a wide range of applications in the healthcare area. Some of implantable sensors can be implemented in measuring enzymes and others are used to measure blood pressure. In other words biomedical sensors are classified according to the quantity to be measured and categorized as physical, electrical, or chemical, depending on their use in an application. Implantable sensors form an important class of biosensors according to their ability to provide metabolite(s) level(s) continuously without the need for the intervention of patient and regardless of the patient's physiological state (rest, sleep, exercise, etc.). The Implantable sensors should be extremely small so that it can be easily implanted and explanted with less damage to the tissues nearby

Security of data collection and transmission in ISs networks is critical issue. Several research works in the wireless networks security field have identified serious security and privacy risks in implantable medical systems that could compromise the implant and even the health of the patient who carries it. In the end of this paper we provide security issues for the next generation of implantable medical devices and analyze the most relevant protection mechanisms proposed till now. On the one hand, the security mechanisms must have into consideration the inherent constraints of these small and implanted devices: energy, storage and power computing. On the other hand, the proposed solutions must achieve an adequate balance between the safety of the patient and the security level offered, with the battery lifetime being another critical parameter in the design phase

There are some challenges to be overcome to obtain the ideal implantable systems. Nano-communication is considered to become a major building block for many novel applications in the health care and fitness sector. Given the recent developments in the scope of nano-machinery, coordination and control of these devices becomes the critical challenge to be solved. Advances in nanotechnology of implantable devices area have opened up great opportunities, while at the same time raised some concerns. One pressing issue to address is the biocompatibility of nano- materials that are used to enhance implantable sensors performance.

There are some problems of the use of high selectivity materials, low detection limit, a wide detection range, and fast response time, all while trying to make these sensors are ready to continuous glucose measurement. In the future, research will continue to work for detecting infinitesimally small concentrations of glucose via different bodily fluids and in forming sensors that are capable of being incorporated in to portable, subcutaneous, and miniaturized implantable devices. All these requirements urge the continuous exploration to revolutionize the glucose biosensor industry.

The increasing incidence of cancer, heart failure, and other diseases has stimulated research on the development of novel implantable devices for the localized treatment of cancer. Cancer is currently the second largest cause of death worldwide, after cardiovascular disease. Current trends also suggest that cancer will become the leading cause of death by 2030. Implantable sensors should be integrated with other technologies to overcome all these challenges.

Recent years have witnessed an increasing demand in the use of smart ISs for healthcare applications. In addition, new emitters are constantly entering the marketplace and more medical procedures are based on electromagnetic fields as well. Technical design improvements will enhance the functions of ISs for the quality of life and longevity.

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This contribution presented an overview of implantable sensorsin biomedical technology. Some critical problems, privacy and security of implantable sensors, challenges, and future trends to overcome some issues in the development of this technology have been presented.

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