SENSOR TECHNOLOGIES FOR HEALTH MONITORING SYSTEMS

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ABSTRACT

The evolution of sensor technologies has led to the development of modern health monitoring systems. These technologies are the main component of modern health monitoring systems. There are four essential sensor technologies used in health monitoring systems. The four sensing technologies are smart sensors, gas sensors, biomedical sensors, Wireless Sensor Networks.

Keywords: smart sensors; gas sensors; biomedical sensor; WSN.

Smart Sensors

The importance of sensors is constantly growing as a component of overall solutions for environmental monitoring and assessment, eHealth (digital healthcare), and real-time health monitoring. Besides, there are plenty of appearing sensor applications to spread across large areas while retaining flexibility and comfortability. The sensor market will exceed trillion sensors per year soon. Therefore, for smart sensor development, the manufacturing should be low cost, high output, and with short fabrication cycles [1].

Smart sensor is a device that samples signals taken from the physical environment and processes them with its built-in computing resources before passing them to a centralized sensor hub. Smart sensors are key integral elements of the IoT notion [2]. One implementation of smart sensors is as components of wireless sensor networks (WSNs) whose nodes can number in thousands, each of which is connected with other sensors and with the centralized hubs. Smart sensors are used in numerous applications including scientific, military, civil, and home applications.

Gas Sensors

Gas sensors are a class of chemical sensors. Gas sensors determine the concentration of gas in its neighborhood. Gas sensing systems are increasingly investigated for applications in environmental monitoring (air quality control, fire detection), automotive industry (fuel combustion monitoring and polluting gases of automobiles), industrial production (process control automation, detection of gases in mines, detection of gas leakages in power stations), medical applications (e.g., electronic noses, alcohol breath tests), boiler control, home safety, etc [3].

Different types of gas sensors exist such as optical, surface acoustic wave (SAW), electrochemical, capacitive, catalytic, and semiconductor gas sensors. Gas sensing methods can be split into two categories: based on variation of electrical properties and based on variation of other properties [4].

Biochemical Sensors

Biochemical sensors can convert a biological or chemical amount into an electrical signal. The biosensor includes a receptor, chemically sensitive layer, transducer and electronic signal processor.

Biochemical sensors intended for detection of electrical signal either directly sense the electric charges (amperometric sensors) or they sense the electric field induced by electric charges (potentiometric sensors) [5].

System-on-chip (SoC) biosensors are integrated on-chip and connected the active circuitry. SoC biosensors have numerous improvements with respect to sensors based on principles such as mechanical, optical and other methods [6].

Planar semiconductor (CMOS technology) devices can be used as the foundation for biological and chemical sensors where sensing can occur optically or electrically [7].

Most of the electrical biosensor chips are based on CMOS and MEMS technology. MEMS systems are a combination of electronics and mechanical structures at a micro- and nanometer scale. The reason for using these technologies is the ease of integration onto a CMOS chip in which the electrical signals are processed. Typical applications include poly-silicon nanowire-based DNA or protein sensors, cantilever-based DNA sensors, pH sensors based on Ion-Sensitive-FET, glucose sensors, temperature sensors, etc [2].

Wireless Sensor Networks

Current developments of Micro Electro Mechanical Systems (MEMS) technology and communications allowed for the advent of low-cost, low-power sensor nodes having multiple functions in a compact form factor. They are the basis of wireless sensor networks.

Wireless Sensor Networks (WSNs) comprises huge number of sensor nodes (also called motes) that are spatially distributed autonomous devices that can accept input information from the connected sensor(s), process the information and transmit the output to other devices via a wireless network. WSNs were driven initially by military applications (e.g. battlefield surveillance), but now they are transformed in civil applications inspired by the IoT notion, such as home and building automation, traffic control, transport and logistics, industrial automation, environment monitoring, health monitoring, agricultural and animal monitoring, etc [8].

Nowadays, wireless sensor networks are allowing a level of integration between computers and the physical world that has been unthinkable before. Advances in microelectronics and communications industries have been a key enabler of the development of huge networks of sensors. Nevertheless, wireless connectivity of sensors might be considered an application facilitator rather than a feature of the sensors. This is due to the fact that wired sensor networks on the scale that is required would be too expensive to set up and maintain, which means they are unusable for applications such as monitoring of the environment, health, military, etc [9].

Conclusion

In conclusion, the above-mentioned sensor technologies are widely used in modern health monitoring systems. With the help of these technologies, huge advances are being made in the health monitoring system. The integration of such technologies can be seen as a solution to problems in the health care system.

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