Wireless Integrated MicroSystems: Wearable and Implantable Devices for Improved Health Care

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Abstract

Much of the early work on integrated sensors was directed at biomedical applications, but until recently relatively few implantable devices had progressed to clinical use. However, microsystems merging MEMS with low-power circuits, wireless interfaces, advanced power sources, and wafer-level hermetic packaging are now emerging to significantly improve health care and reduce cost. Catheter-tip pressure sensors have evolved to active stents capable of detecting arterial restenosis, and wireless intraocular pressure sensors are being developed for use in treating glaucoma. Early work on wafer-scale gas chromatography systems has evolved into microsystems that promise wristwatch-size high-speed gas analysis at ppb levels, including the detection of biomarkers in breath for diseases such as lung cancer and tuberculosis. Neural bioelectronic interfaces are beginning to revolutionize our understanding of the central nervous system while providing a basis for prosthetic devices for disorders such as deafness, blindness, severe epilepsy, Parkinson's disease, and paralysis. The present state of these areas will be reviewed along with future challenges and expected impacts on health care.