World Academy of Science, Engineering and Technology
International Journal of Electrical and Computer Engineering
Vol:9, No:09, 2015

The Implantable MEMS Blood Pressure Sensor Model With Wireless Powering And Data Transmission

Authors : Vitaliy Petrov, Natalia Shusharina, Vitaliy Kasymov, Maksim Patrushev, Evgeny Bogdanov

Abstract : The leading worldwide death reasons are ischemic heart disease and other cardiovascular illnesses. Generally, the common symptom is high blood pressure. Long-time blood pressure control is very important for the prophylaxis, correct diagnosis and timely therapy. Non-invasive methods which are based on Korotkoff sounds are impossible to apply often and for a long time. Implantable devices can combine longtime monitoring with high accuracy of measurements. The main purpose of this work is to create a real-time monitoring system for decreasing the death rate from cardiovascular diseases. These days implantable electronic devices began to play an important role in medicine. Usually implantable devices consist of a transmitter, powering which could be wireless with a special made battery and measurement circuit. Common problems in making implantable devices are short lifetime of the battery, big size and biocompatibility. In these work, blood pressure measure will be the focus because it's one of the main symptoms of cardiovascular diseases. Our device will consist of three parts: the implantable pressure sensor, external transmitter and automated workstation in a hospital. The Implantable part of pressure sensors could be based on piezoresistive or capacitive technologies. Both sensors have some advantages and some limitations. The Developed circuit is based on a small capacitive sensor which is made of the technology of microelectromechanical systems (MEMS). The Capacitive sensor can provide high sensitivity, low power consumption and minimum hysteresis compared to the piezoresistive sensor. For this device, it was selected the oscillator-based circuit where frequency depends from the capacitance of sensor hence from capacitance one can calculate pressure. The external device (transmitter) used for wireless charging and signal transmission. Some implant devices for these applications are passive, the external device sends radio wave signal on internal LC circuit device. The external device gets reflected the signal from the implant and from a change of frequency is possible to calculate changing of capacitance and then blood pressure. However, this method has some disadvantages, such as the patient position dependence and static using. Developed implantable device doesn't have these disadvantages and sends blood pressure data to the external part in real-time. The external device continuously sends information about blood pressure to hospital cloud service for analysis by a physician. Doctor's automated workstation at the hospital also acts as a dashboard, which displays actual medical data of patients (which require attention) and stores it in cloud service. Usually, critical heart conditions occur few hours before heart attack but the device is able to send an alarm signal to the hospital for an early action of medical service. The system was tested with wireless charging and data transmission. These results can be used for ASIC design for MEMS pressure sensor.

Keywords : MEMS sensor, RF power, wireless data, oscillator-based circuit
Conference Title : ICECEBE 2015 : International Conference on Electrical, Computer, Electronics and Biomedical Engineering
Conference Location : Paris, France
Conference Dates : September 21-22, 2015