Adaptive Model of Cardiovascular system: realization and signal database

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Abstract. The paper deals with a study of relationship between hemodynamic parameters and other various vital signs based on the modelling of hemodynamic parameters. The design of an adaptive mechanical model of cardiovascular system is presented in the paper. The connection between the modelling of cardiovascular system and smart homes and ambient assisted living applications is also discussed.

Keywords: cardiovascular system, vital signs, telemetry

1 Introduction

The poster deals with a study of relationship between hemodynamic parameters and other various vital signs based on the modelling of hemodynamic parameters.

Modelling is one of the approaches to understanding complex biological systems. In the field of biomedical engineering it is important to have robust background knowledge about dependencies between various vital signs. As cardiovascular diseases are very frequent with the elderly in developed countries, the modeling of cardiovascular system and the connection between hemodynamic parameters and other vital signs seems to be a very important task.

2 Methods and Results

The system we introduce in the work is designed as a combination of a telemetry system and a mechanical model of cardiovascular system. The main task of the telemetry system is to monitor vital signs, e.g. electrocardiogram (ECG) and peripheral photoplethysmogram (PPG). The other considered parameters are the phonocardiogram (FCG), breathing activity, transthoracic bioimpedance and physical activity sensed by accelerometers. The system consists of electrodes and sensors for monitoring of vital signs, input modules converting the sensed physical values to the electrical values, microprocessor unit and wireless communication module (bluetooth or wi-fi depending on required distance between

sensed person and controlled model). The model of the cardiovascular system is a set of pipes representing arteries and veins, the pump representing the heart, sensors and the electronic circuits serve as hemodynamic parameters monitor and pump driver. The model is able to change of the system parameters such as heart rate, cardiac output and resistance of the vascular system. The system allows measuring various hemodynamic parameters e.g. blood pressure, blood flow, pulse wave velocity, type of the flow etc.

The poster presents the realization of the system and the signals acquired with the model.

3 Conclusion

The complex system connecting the telemetry sensing of vital signs and the mechanical modelling of the cardiovascular system has been designed and being realized. The system increases the possibilities to study relationships between vital parameters and to improve existing and develop new methods for classifying life threatening situations. These methods could be effectively used in the smart homes facilities and in the ambient assisted living.

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