A Cardiac Telerehabilitation Application for Mobile Devices

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Cardiac rehabilitation is a new branch of medical rehabilitation and is dedicated for patients after coronary events. The main purpose of the rehabilitation is to help patients recover quickly and improve their general physical, mental and social well-being. The goal is to stabilize and reverse the progression of cardiovascular diseases which reduces the risk of another cardiac events. The aim of our research was to develop a telerehabilitation system that integrates the wireless ECG signal recorder with a mobile device in a Bluetooth-based body surface network. The software detects the QRS complex and calculates the heart rate as the main ECG exercise-dependent parameter on-the-run. The monitoring system integrates the current heart rate of the patient with the GPS data. This gives us the opportunity to observe the dependence of heart rate variability and speed. The application allows the physician to build a cardiac rehabilitation program which can be divided into several levels. Each level let the physician to customize parameters as: duration, speed, maximal and minimal heart rate. For the implementation of the QRS complex detector the Pan and Tompkins algorithm has been selected. Tests of correct implementation of the QRS detection algorithm were carried on the records from the MIT-BIH Arrhythmia Database. The performance of the algorithm was affected by various artifacts of the raw ECG signal such as noise or baseline wandering and by the QRS polarity. Using the 48 records from MIT-BIH Arrhythmia Database the algorithm failed to properly detect less than 2% of the beats. For monitoring purpose the result is satisfying.

In conclusion, achieved results indicate that the application can be used by patients for cardiac rehabilitation. This is an opportunity for people that live in remote and rural areas outside the regional centre and are faced with the usual difficulties of attending urban health-care programs.