

iCareWell: Real-time Wellness Monitor

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INTRODUCTION

EMERGENCE and proliferation of wearable physiological sensors and wireless communication standards and devices enable implementation of personal assistants that are capable of continual sensing and real-time processing of physiological signals and physical activity during daily activities [1]. Pervasiveness of smartphones and increasing number of health-related applications on smartphones have the potential to revolutionize ubiquitous health and wellness monitoring [2]. We are developing individual Cardiac and Wellness Assistant – *iCareWell* – to monitor health and wellness status using standard sensor and smartphone technologies.

MATERIALS AND METHODS

We implemented a wearable monitoring system for real-time monitoring of heart rate, heart rate variability, and physical activity using wearable sensors and a smartphone,



Fig. 1. Real-time monitoring of occupational stress using Wireless Body Area Network of wearable sensors.

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in our case iPhone. Collected records are processed in real-time on smartphone to create a custom, personalized, prolonged record of physiological parameters.

iCareWell is an integrated mobile health monitoring system designed to monitor physical activity and heart activity, and collect responses from the user. The *iCareWell* system architecture is shown in Figure 1. Users wear a standard heart monitoring belt and a foot pod sensor. Both sensors communicate with a personal server in a wireless body area network (WBAN) using Ant+ low power wireless standard. The personal server is implemented on an iPhone that is augmented with an Ant+ gateway – Wahoo Fisica key [3]. All interbeat intervals (RR intervals) and step count in 15 second intervals are collected. Both parameters are used to assess change of heart rate caused by physical activity.

All personalized measurements are processed relative to the personal baseline. The user can also monitor their weight and GPS location. All records are periodically sent to a central server. A customized questionnaire is automatically generated if some parameters exceed critical threshold. At the moment we use only heart rate, but we are developing a customized formula for application specific events. Questionnaires and thresholds are configured in the central database for every application.

RESULTS

We developed a prototype real-time health assistant integrated into ubiquitous health monitoring system. The system can: a) support healthy subject to track their cardiac health and wellness status, b) assist cardiac rehabilitation patients, and c) support physicians and healthcare professionals by allowing them to verify patient's health status and verify their compliance. We currently use the system to monitor and analyze real-time occupational stress [4]. We are currently developing personalized formulas for assessment of health status and stress level.

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