WHEAMO: A WIRELESS HEALTH PLATFORM FOR MONITORING PANCREAS-RELATED DISEASES

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Introduction

This work presents a wireless e-health platform developed in the context of the Wheamo (Wireless Health Monitoring) project[1], which aspires to provide an end-to-end solution for monitoring the critical parameters whose pathological values are linked to pancreas-related diseases such as pancreatitis and pancreatic cancer.

Materials and methods

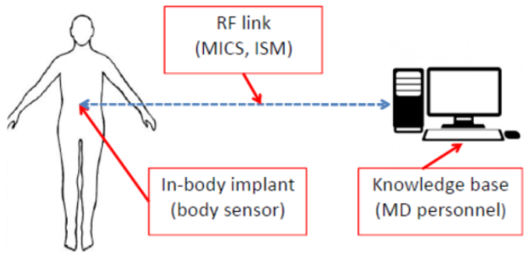

Figure 1. The Wheamo platform

The Wheamo platform employs medical implants (bio-sensors) that function as antennas planted in the pancreas. Via wireless in-body propagation, the signal that monitors and records critical parameters such as glucose, reaches the skin and then is propagated in a 3D indoor environment (i.e., a medical room) over to a terminal equipped with a user-customized, adaptive, and personalized knowledge base operated by medical personnel and other health care workers.
The fundamentals of in-body and on-body wireless propagation and channel characterization have been studied in a series of published works [1]-[3]. Researchers have tested both electric-field (dipole) and magnetic-field (patch, loop) antennas. Another important aspect concerns the frequency band in which the signal propagation will occur. Among the frequencies that have gathered scientific and academic interest are the Medical Implant Communication Service (MICS) band at 402-405 MHz, the 900 MHz channel and the industrial, scientific and medical (ISM) radio band at 2.45 GHz.

1 www.wheamo.com

Results

Different channel links and different carrier frequencies lead to different behavior of signal attenuation while propagating inside the human body or on the skin surface. Path loss modeling has been mostly based on mathematical fitting of distributions and models on the empirical data acquired via simulations with male and female phantoms built in specific software available to researchers in industry and academia. In order to remove noise that is correlated with eye-movement (EOG) and heart motion (ECG), the Second Order Blind Indedification (SOBI) source separation algorithm [2] can be used. The algorithm works with the use of *joint diagonalisation* on a set of partial covariance matrices. The SOBI modification addressed in this study concerns the way that covariance matrices are diagonalized.
Extensive simulations have been conducted by employing appropriate software that uses human phantoms, both male and female, for both the MICS and the ISM frequency bands, in order to model the propagation of the EM radiation throughout the human body from the pancreas to the skin, with the methodology first established in [4]-[5].
Results confirm the departure of small-scale fading from the Rayleigh distribution in terms of instantaneous signal amplitude, a typical scenario for Non-Line-of- Sight (NLOS) scenarios such as in-body channel propagation. Large-scale fading confirms the Log-normal model, albeit with variations.

References

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Keywords:
in-body propagation, channel modeling, e-health, pancreas