Unobtrusive Health Monitoring for Elderly People Living in their Domestic Environment
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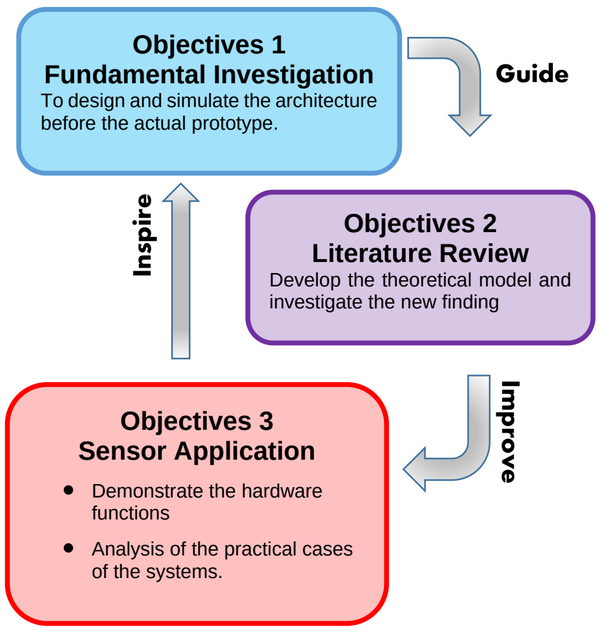
Introduction

Nowadays, most of the public would not prioritize for routine health check-ups, face the time constraints, and transportation difficulty to visit health provider as long as they feel healthy [1]. Therefore, to help the public to take care of their health within the comfort of their own home, there is the need to provide them with a health monitoring system with a low cost and easy to use sensor technique [2]. To achieve that, this study proposes a design of a patient monitoring system which can monitor body fluid level, stroke volume, respiratory and pulse rate [3]. By using the proposed system, medical personnel can further monitor [4] and analyze a patient's condition at his/her office or home without the need to meet patients.

Research Objectives

This study aims to design an unobtrusive healthcare monitoring solution which implements the vital sign monitoring and body composition estimation. As an example, for an item of daily routine that can be seamlessly extended with health monitoring this project will focus on the toilet seat.



Methods

A proof-of-concept of a radar-based vital sign detection system [5] will be developed with state of the art of Intelligent Reflecting Surface for vital Sign Communications [6]. Unlike the contact-based vital signs monitoring systems, radars do not require any contact probe to be attached to the body of the human being to acquire respiratory and cardiac rates with high accuracy.

This research will consist of the following main stages:

a) Pre-design Stage
- Literature review.
- Problem statement.
- Design conceptual understanding

b) Design/Simulation Stage.
- Metasurface-Intelligent reflecting surface design at 2.4 GHz frequency.
- CW Radar hardware setup and configuration.

c) Prototype Stage and fabrication
- Fabrication through traditional substrates such as FR4, Teflon, Taconic, or Rogers.

d) Measurement Stage
- S11, VSWR, Gain, Maximum reflection phase variation and radiation pattern measurement using an Anechoic Chamber.
- Polarization Measurement

Furthermore, in a second part of this thesis we will investigate the feasibility of using Bioimpedance as a measurement technique that can be integrated into the toilet seat and give an estimate for body composition and therewith thirst (Bioimpedance spectroscopy) and stroke volume (Impedance cardiography).

Aim

- To help the public to take care of their health within the comfort of their own home.
- to provide elderly with a health monitoring system which is low cost and easy to use and decrease time consumption.
- By using the proposed system, medical personnel can further monitor and analyze patient's condition at his/her office or home without the need to meet patients.
- Improving the experience of care, improving the health of populations, and reducing per capita costs of health globally.

Data Collection and Validation

One gal is to design the radar antenna and metasurface with profitable characteristics, including proper penetration, flexibility, mobility, and reduction in multipath reflections for healthcare services at 2.4 GHz frequency and to get a high-performance antenna to cope with the impact of raised atmospheric, absorptions and attenuations. Solving the above-mentioned parameters will be performed by using EXCEL, CST, ADS and/or HFSS. Furthermore, a new design will be simulated by using HFSS and fabricated a prototype to test its characteristics. Afterwards, the simulated results will be compared with the recorded ones and a report about this final analysis will be written. compare them to analyze and report it. Finally, Antenna radiation characteristics like $S11$, axial ratio, beamwidth, gain, bandwidth, and radiation pattern will be presented and discussed and the measurement data from vital sign monitoring will also be discussed.

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