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Systems for remote monitoring of indoor air quality and respiration of wheelchair users

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Abstract: Pulmonary function is reduced in people with impaired mobility. Remotely, unobtrusive respiratory function monitoring can reduce cost and enhance healthcare quality, safety and efficiency for people with motor activity impairments. The paper describes two systems for remote monitoring of respiratory function and indoor air quality: a mobile wearable solution based on EMFi sensing technology, and a wheelchair embedded solution based on microwave Doppler radar technology. The air quality monitoring is performed using solid state sensors for temperature and relative humidity. The systems use Bluetooth compatible smart sensing nodes that deliver the information to a smart phone running an Android operating system (OS) that is used as graphical user interface and as a data bridge between the sensing nodes and an advanced data processing server. Preliminary results on reliability test of the two systems for respiratory function monitoring are presented. Good sensibility and efficiency of radar system in detecting respiratory rate offer opportunity to unobtrusively and remote monitoring of the respiratory function of wheelchair users.

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I. Introduction

The majority of the population in high and middle income countries dies from chronic diseases. In the population aged under 65 years, deaths due to chronic diseases occur much less frequently than in the older population but still account for nearly 60 % of all deaths [1]. The major rate of mortality induced by chronic diseases are associated with cancer, coronary artery diseases and respiratory disease. Respiratory distress could occur in all age groups but is particularly prevalent in the frail. Moreover, it is projected that chronic obstructive pulmonary diseases will be the third leading cause of death worldwide by 2020 due to an increase in smoking rates and demographic changes in many countries [2],[3]. Respiratory distress is the second most common symptom of adults transported by ambulance, and is associated with a relatively high overall mortality before hospital discharge [4].

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