A Package Of Smartphone and Sensor-Based Objective Measurement Tools For Physical And Social Exertional Activities For Patients With Illness-limiting Capacities

Abstract

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Patients with several incompletely diagnosed and understood chronic diseases suffer from symptoms that limit their functional capacity. In particular, patients with chronic fatigue syndrome/myalgic encephalomyelitis (CFS/ME) and long covid syndromes have variable fatigue, malaise, poor and unrefreshing sleep, and delayed post-exertional exacerbations of these symptoms. There are no specific tests for these patients to diagnose their diseases properly. These patients must be aware of their daily activities and energy expenditure. Even a little physical effort or socially extroverted behavior can make them tired and incapable of continuing their daily routine. A comprehensive summary of the measured activities at any particular time of the day will eventually help the patients take precautions and prevent any unwanted physical or social burnout.

To address the current problems faced by these patients, we used a pair of smart-insoles and a wrist-worn sensor-integrated device to accurately detect and measure eleven activities of daily living. We developed a smartphone application and utilized the smartphone’s microphone to analyze the recorded sound buffer and detect voice activities and high-level noise exposures. We also explored the sensors of the smartphone to compare with the result from the smart-insoles.

In this work, we present a practical package for patients with limited functional capacities due to illness. We describe the design and development of a smartphone application that collects the data from the sensor device and microphone, sends them to a server for machine learning calculation, and provides a comprehensive summary by objectively measuring the activities. The application works as the core component of the package that connects all the other components via BlueTooth and use network protocol to send raw data to the server.